

Work-Related Asthma in the Cannabis Industry

Findings From California, Massachusetts, Michigan, and Washington

Michelle Pacheco, MPH, Kathleen Fitzsimmons, PhD, Carolyn Reeb-Whitaker, MS, Kenneth Rosenman, MD, Jennifer Flattery, MPH, Justine Lew Weinberg, MS EHS, Mary Jo Reilly, MS, Sarah Yiu, MPH, Coralynn Sack, MD, Danièle Todorov, MS, Robert Harrison, MD, Katelynn E. Dodd, MPH, and Emily Sparer-Fine, ScD

Objective: Describe work-related asthma (WRA) cases and associated exposures in the legalized cannabis industry. **Methods:** Using data from four state-based surveillance systems (California, Massachusetts, Michigan, and Washington), WRA cases within the cannabis industry were identified and classified as new-onset asthma or work-aggravated asthma. **Results:** From legalization dates (1996 in California, 2012 in Massachusetts, 2008 in Michigan, 1998 in Washington) through 2023, 30 WRA cases were identified. A majority were aged 18 to 34 years (66.7%) and were male (60%). Thirteen (52%) cases were new-onset asthma,

From the Massachusetts Department of Public Health, Occupational Health Surveillance Program, Boston, Massachusetts (M.P., K.F., S.Y., E.S.-F.); Washington State Department of Labor and Industries, Safety and Health Assessment and Research for Prevention (SHARP) Program, Olympia, Washington (C.R.-W., D.T.); Department of Medicine, Division of Occupational and Environmental Medicine, College of Human Medicine, Michigan State University, East Lansing, Michigan (K.R., M.J.R.); California Department of Public Health, Occupational Health Branch, Richmond, California (J.F., R.H.); Public Health Institute, Contractors to the California Department of Public Health, Occupational Health Branch, Richmond, California (J.L.W.); Department of Medicine, University of Washington, Seattle, Washington (C.S.); and Respiratory Health Division, National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, Morgantown, West Virginia (K.E.D.).

ORCID: 0000-0001-7272-6394

ORCID: 0000-0002-8215-2993

ORCID: 0000-0002-9176-2013

ORCID: 0000-0002-2053-4849

ORCID: 0000-0002-3158-4649

ORCID: 0009-0004-4554-0059

ORCID: 0000-0002-7267-9409

ORCID: 0000-0003-1825-6066

ORCID: 0000-0002-7545-2509

ORCID: 0000-0002-9896-7345

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Address correspondence to: Emily Sparer-Fine, ScD, 250 Washington St, Boston MA 02128 (emily.sparer-fine@mass.gov).

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LEARNING OUTCOMES

- Describe occupational and demographic characteristics of workers in the cannabis industry with work-related asthma (WRA).
- Describe the types of exposures that workers in the cannabis industry may experience and their potential links to WRA.
- Assess how data from state-based surveillance systems contribute to understanding occupational health risks, specifically in the cannabis industry.
- Understand the importance of describing workers with WRA in emerging industries such as cannabis and its implications for prevention.

and 12 (48%) were work-aggravated asthma, with two fatalities. The most frequently reported exposure was plant materials (40.4%), of which 94.7% were cannabis dust and/or marijuana plant. Most cases (69%) worked in indoor cultivation/processing. **Conclusions:** Cannabis industry workers are at risk for WRA, emphasizing the need for interventions to address workplace respiratory hazards.

Keywords: marijuana, respiratory, fatal case reports, epidemiology, prevention, surveillance, occupational

Work-related asthma (WRA) is asthma that is caused or made worse by workplace exposures. It includes new-onset occupational asthma (OA) with or without latency, as well as aggravation of preexisting asthma.¹ Approximately 10% to 20% of adult asthma cases are caused by workplace exposures.² It is estimated 15% to 22% of adults with asthma suffer work-related exacerbations.² In population-based surveys, individuals with WRA had higher mean numbers of days with asthma symptoms, were more likely to not be able to work or perform usual activities, and used more asthma medication compared with adults with non-WRA.^{3,4} In four states in the United States (California, Massachusetts, Michigan, and Washington), cases of WRA are identified through public health surveillance, and information is used to tailor prevention efforts by employers, health care providers, and/or occupational safety and health regulators and other professionals.¹ Surveillance of WRA allows for the identification of industries with workplace exposures that put workers at risk for WRA. The expanding legalized cannabis industry is emerging as an industry where workers are at risk for WRA.^{5,6}

In the United States, the term *cannabis* or *marijuana* refers to strains of cannabis that contain greater than 0.3% tetrahydrocannabinol, the psychoactive component of the cannabis plant—*Cannabis sativa*.⁷ While cannabis is strictly regulated by federal authorities, specific use regulations vary across jurisdictions, and many US states and territories have recently established legalized medical and/or adult-use recreational cannabis industries.⁷ As of July 2024, medical cannabis is legal in 38 US states, as well as the District of Columbia, Guam, Puerto Rico, and the US Virgin Islands.⁸ Recreational cannabis is legal

in 24 US states, as well as the District of Columbia, Guam, and the Northern Mariana Islands.⁸ As of 2024, there were approximately 440,000 full-time equivalent jobs in the legal cannabis industry in the United States (78,618 in California, 27,407 in Massachusetts, 46,746 in Michigan, and 18,745 in Washington).⁹ The federal government also plays an important role in the health and safety of cannabis workers.^{5,7}

Workers in the cannabis industry may be exposed to a number of different respiratory hazards, including the cannabis itself, ozone (an irritant gas), mold, endotoxin, and pesticides, including disinfectants.^{10–13} The health impacts of these hazards are becoming increasingly apparent. The first known WRA fatality was previously reported in a female in her 20s with no history of asthma employed at a Massachusetts indoor cannabis cultivation and processing facility. The decedent had a documented history of new breathing problems associated with cannabis dust exposure, which resulted in a fatal WRA attack after 7 months of employment.^{5,14} In addition, one small cross-sectional study found a high prevalence of work-related allergic and respiratory symptoms among 22 (71%) of 31 indoor cannabis grow workers, of whom 13 (42%) had symptoms suggestive of asthma.¹⁵ The study also found evidence of cannabis sensitization following skin prick testing among five workers. A second small cross-sectional study found eye (24%), nasal (31%), respiratory (24%), and dermal (10%) symptoms among 29 cannabis workers, and 38% of the participants reported symptoms suggestive of asthma.⁶ A detailed 10-case series for cannabis-associated WRA documented seven cannabis industry workers with exposure to cannabis dust, one police officer with exposure to cannabis material and mold, and two social service workers with exposure to mixtures that included cannabis.¹⁶

The purpose of this study was to describe workers with WRA and associated exposures in the cannabis industry using data from four state-based WRA surveillance systems.

METHODS

The National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention currently funds surveillance of WRA in four states: California (since 1993), Massachusetts (since 1993), Michigan (since 1988), and Washington (since 2001).¹⁷ WRA surveillance methods, including case identification, confirmation, and classification, have been previously described.^{1,16–22} Briefly, workers with potential WRA are identified using multiple data sources including, but not limited to, health care provider reports, hospital data, and workers' compensation data. Additional information on worker demographics, industry, occupation, workplace exposures associated with asthma symptoms, medical history, and tobacco smoking history is obtained from standardized follow-up telephone interviews with workers and/or review of medical records. This information is used to describe cases and to confirm and classify WRA.

All four states use the same WRA surveillance case definition requiring a health care professional's diagnosis that is consistent with asthma and an association between symptoms of asthma and work. Each case is classified into one of the following categories: work-aggravated asthma (WAA), defined as preexisting asthma that is exacerbated by workplace exposures, or new-onset asthma (NOA), defined as asthma in persons with no history of asthma, or preexisting asthma that has been asymptomatic for at least 2 years prior to the onset of their work-related symptoms.¹ NOA includes OA either from a known inducer previously associated with OA as per the Association of Occupational and Environmental Clinics (AOEC) or from an unknown inducer; and Reactive Airway Dysfunction Syndrome, which is new asthma that develops within 24 hours of exposure to high levels of an irritating vapor, gas, fume, or smoke and last at least 3 months.²³ Confirmed WRA cases for which there is insufficient information to classify into one of the above categories are also included in the surveillance data. Reported exposures were coded according to AOEC Exposure Codes; a given case could be assigned up to five AOEC codes.²³

Industry and occupation were coded according to the 2002 North American Industry Classification System and 2000 Standard Occupational Classification codes, respectively.²⁴ WRA cases associated with the cannabis industry were those who were reported after the respective state first legalized cannabis to the end of calendar year 2023 and were ascertained using North American Industry Classification System Codes: 111419; 111,998; 325,411; 424,590; 453,998; and 493,130. The dates of legalization vary by state: California legalized medical cannabis in 1996 (and later recreational cannabis in 2016); Massachusetts legalized medical cannabis in 2012 (and recreational cannabis in 2016); Michigan legalized medical cannabis in 2008 (and recreational cannabis in 2018); and Washington legalized medical cannabis in 1998 (and recreational cannabis in 2012).

Frequency and proportion of WRA cases in the cannabis industry were analyzed by age, sex, race, Hispanic ethnicity, years worked in the industry, use and status of workers' compensation (WC), personal cannabis use and tobacco smoking status, case ascertainment source, classification of WRA, type of work, US state where the workplace was located, and exposure. Information on whether and how (e.g., smoked) a worker used cannabis recreationally was not routinely collected, but was included in analyses if available. Analyses were completed using SAS version 9.4 and Microsoft Office Professional Plus Excel 2016. The denominator used for proportions varied by characteristic since missing information varied by characteristic.

RESULTS

Since legalization for each state, respectively, to the end of calendar year 2023, a total of 30 WRA cases among workers at licensed cannabis businesses were identified in California (n = 10), Massachusetts (n = 5), Michigan (n = 5), and Washington (n = 10). Demographics, including age, sex, race, and Hispanic ethnicity, as well as select characteristics, are presented in Table 1. A majority of cases were between the ages of 18 and 34 years (n = 20, 66.7%) and male (n = 18, 60%). Information on race was missing/unknown for nearly half of cases (n = 13), and Hispanic ethnicity was missing/unknown for more than two-thirds (n = 19) of cases. Of the 17 cases with information on race, the majority were White (n = 14/17, 82.4%).

Among the 21 cases (70%) for which WC filing status was reported by the case, 14 (66.7%) had filed a claim. Among those who had filed a claim, 12 (85.7%) had a known outcome; 5 (41.7%) had received WC benefits, 6 (50%) were denied WC benefits, and 1 (8.3%) claim was pending.

Of the 21 WRA cases with known tobacco smoking history, 10 (47.6%) were found to be current (n = 1) or former (n = 9) tobacco smokers. Of the 16 WRA cases with known personal cannabis history, 13 (81.3%) reported personal cannabis use. Among the 10 WRA cases who were known current or former tobacco smokers, 3 (30%) were also personal cannabis users. Additionally, of the 22 WRA cases with known working history, 19 (86.4%) had worked 3 years or less in the cannabis industry, with 11 (50%) having worked in the industry for less than 1 year before onset of symptoms. A majority of the WRA cases were ascertained through WC data (n = 16, 53.3%), followed by hospital data (n = 7, 23.3%) and other reporting sources (n = 6, 20%) (Table 1).

Of the 25 WRA cases that could be classified, 12 (48%) were classified as WAA, and 13 (52%) as NOA (Table 2). All NOA cases were OA, and three had worked in the industry for less than 1 year (data not shown). For five confirmed WRA cases, there was insufficient information to classify the specific type of asthma (Table 2).

The majority of WRA cases (n = 20, 69%) worked in the indoor cultivation/processing industry (Table 3). Among them, 15 (75%) were employed as cultivation, processing, and packaging workers (Table 3).

Among the 30 WRA cases, a total of 47 exposures were coded. The most frequently reported exposures were plant materials (n = 19, 40.4%), of which 18 (94.7%) were cannabis dust and/or marijuana

TABLE 1. Number and Percentage of Work-Related Asthma Cases in the Cannabis Industry by Select Characteristics (n = 30)^a

	n	%
State		
California	10	33.3
Massachusetts ^b	5	16.7
Michigan	5	16.7
Washington ^c	10	33.3
Age (y)		
18–34	20	66.7
35–49	7	23.3
50–64	3	10.0
≥65	0	0.0
Sex		
Female	12	40.0
Male	18	60.0
Race ^d		
American Indian, Alaska Native	1	5.9
Asian	0	0.0
African American	1	5.9
White	14	82.4
Other (including more than one race)	1	5.9
Unknown	13	—
Ethnicity ^d		
Hispanic or Latino	3	27.3
Not Hispanic or Latino	8	72.7
Unknown	19	—
Years worked in industry ^d		
<1 y	11	50.0
1–3 y	8	36.4
4–5 y	1	4.5
>5 y	2	9.1
Unknown	8	—
Workers' compensation filed ^d		
Yes	14	66.7
No	7	33.3
Unknown/refused	9	—
Workers' compensation status ^{d,e}		
Pending	1	8.3
Awarded	5	41.7
Denied	6	50.0
Refused/unknown	2	—
Personal cannabis use status ^d		
Yes	13	81.3
No	3	18.8
Unknown	14	—
Tobacco smoking status ^d		
Current smoker	1	4.8
Former smoker	9	42.9
Never smoker	11	52.4
Unknown	9	—
Case ascertainment source		
Health care provider	1	3.3
Hospital data	7	23.3
Workers' compensation	16	53.3
Other	6	20.0

— Indicates unknown cases not included in the percent calculations.
^aYear of cannabis legalization: California—medical (1996), recreational (2016); Massachusetts—medical (2012), recreational (2016); Michigan—medical (2008), recreational (2018); Washington—medical (1998), recreational (2012)
^bOne case previously published (Weaver 2022)
^cSeven cases previously published (Reeb-Whitaker 2022).
^dPercentages do not include unknown cases.
^eOut of those with a claim filed.

plant, followed by mold and other microorganisms (n = 9, 19.1%), cleaning and disinfecting products (n = 6, 12.8%), and physical factors (humidity, cold, and heat) (n = 3, 6.4%) (Fig. 1).

TABLE 2. Classification of Work-Related Asthma Cases in the Cannabis Industry^a

Classification of Work-Related Asthma ^b	n	%
Work-aggravated asthma	12	48.0 ^b
New-onset asthma		
Occupational asthma	13	52.0 ^b
Reactive airways dysfunction syndrome	0	0.0
Confirmed, but insufficient data to classify	5	—
Total	30	100.0

— Indicates unknown cases not included in the percent calculations.
^aYear of cannabis legalization: California—medical (1996), recreational (2016); Massachusetts—medical (2012), recreational (2016); Michigan—medical (2008), recreational (2018); Washington—medical (1998), recreational (2012).
^bDenominator for asthma classification percent excludes the unclassified cases.

Four cannabis-associated WRA case reports, one each from CA, MA, MI, and WA, are presented as examples of the WRA cases observed in the cannabis industry in Supplemental Digital Content 1 (<http://links.lww.com/JOM/C15>). Case 1 details a fatal asthma attack in an inventory specialist exposed primarily to cannabis dust in a warehouse setting over approximately 20 months of employment. Case 2 describes WAA in a processing agent exposed to cannabis dust and mold. Cases 3 and 4 are NOA in a cultivation technician exposed to a disinfectant formulated with hydrogen peroxide and peracetic acid and in a processor exposed primarily to cannabis dust, respectively. All cases exhibited a temporal relationship between symptoms and work in the cannabis industry; symptoms increased with workplace exposure and decreased in the absence of workplace exposure.

DISCUSSION

The legalization of cannabis and the subsequent rapid growth of the industry throughout the United States have led to concerns about the health of individuals who work in these facilities.^{10,25–28} Ongoing public health surveillance in four states has identified cases of WRA following the legalization of cannabis. WRA is a serious condition that has led to critical health issues among workers in the cannabis industry. The fatal case from California presented here is the second documented WRA fatality among US cannabis industry workers known to the authors at the time of this writing.⁵

A majority (70%) of identified WRA cases within the cannabis industry, specifically in cultivation and processing, were associated with tasks such as growing, harvesting, trimming, grinding, processing and packaging. The workers with WRA most frequently reported that they were exposed to cannabis dust and/or the plant, which comprised 94% of plant material exposures. Previous studies have documented variability of cannabis dust levels in cannabis facilities by tasks, with the highest concentrations observed during grinding and sifting of dried plant product.^{29,30} In the occupational environment with large-scale processes, workers can be exposed to high quantities of cannabis dust over long periods. Components of the cannabis plant and terpenes released from the plant while drying have been shown to include allergens.^{31,32}

Both cannabis dust and smoke, as well as some other biological and chemical agents used in the cannabis industry, are classified as asthma sensitizers by the AOECC.^{10–13,23} Other known asthma sensitizers found in the cannabis industry are biological agents such as *Penicillium* mold, *Alternaria* fungus, and spider mites; and disinfectants formulated with bleach, benzalkonium chloride quaternary ammonium compounds, or mixture of hydrogen peroxide and peroxyacetic

TABLE 3. Classification of Industry and Occupation of Work-Related Asthma Cases in the Cannabis Industry^a

NAICS Title Industry Code ^b	Industry Type	SOC Title Occupation Code ^c	Example Job Duties	n (%) ^d
Other food crops grown under cover: 111,419	Indoor cultivation/manufacturing	Cultivation, processing, packaging workers ^e	Cultivation: clean up and trim plants; tend to plants; cannabis cultivation, watering, defoliating, fertilizing, propagation, harvesting; replanting; transport plants between grow rooms	15 (51.7)
			Postharvest: chop and grind cannabis plants in commercial food processor; package and weigh cannabis; buck, shuck, and trim plants; handling plant after cultivation; preparing and packing edibles; cleaning machines, disinfecting for cross-contamination	
		First-line supervisors and managers ^f	Oversee production of growing onsite; Climate control; in charge of plants	3 (10.3)
		Unknown occupation	—	2 (6.9)
All other miscellaneous crop farming: 111,998	Outdoor cultivation/manufacturing	Farmworkers and laborers, crop, nursery, and greenhouse: 45–2092	Trimming	1 (3.4)
		Unknown occupation	—	1 (3.4)
Medicinal and botanical manufacturing: 325,411	Medicinal manufacturing	Farm, ranch, and other agricultural managers: 11–9011	Chop and grind dried cannabis	1 (3.4)
Other farm product raw material merchant wholesalers: 424,590	Wholesale	General and operations managers: 11–1021	General manager	1 (3.4)
All other miscellaneous store retailers (except tobacco stores): 453,998	Retail	Retail salespersons: 41–2031	Clerical; help customers; ship, receive	3 (10.3)
		First-line supervisors/managers, sales workers: 41–1010	—	1 (3.4)
Farm product warehousing and storage: 493,130	Warehouse	Graders and sorters, agricultural products: 45–2090	Receiving plastic containers of product; opening and stirring product to “aerate” and “burp”; getting product ready for packaging; destroying product that failed testing	1 (3.4)
Unknown industry	Unknown industry	Unknown occupation	—	1

^aYear of cannabis legalization: California: medical (1996), recreational (2016); Massachusetts: medical (2012), recreational (2016); Michigan: medical (2008), recreational (2018); Washington: medical (1998), recreational (2012).

^bNAICS, North American Industry Classification System.

^cSOC, Standard Occupational Classification.

^dDenominator for percentages excludes cases with missing industry and occupation information.

^eDue to overlapping occupations and associated job duties across workers, this occupation category includes SOC occupations 45–2092: farmworkers and laborers, crop, nursery, and greenhouse (n = 9); 51–9111: packaging and filling machine operators and tenders (n = 5); 53–7064: packers and packagers, hand (n = 1).

^fDue to overlapping occupations and associated job duties across workers, this category includes SOC occupations 11–9011: farm, ranch, and other agricultural managers (n = 1), 45–1010: first-line supervisors/managers of farming, fishing and forestry workers (n = 1), and 51–1011: first-line supervisors/managers of production and operating workers (n = 1).

— Indicates unknown.

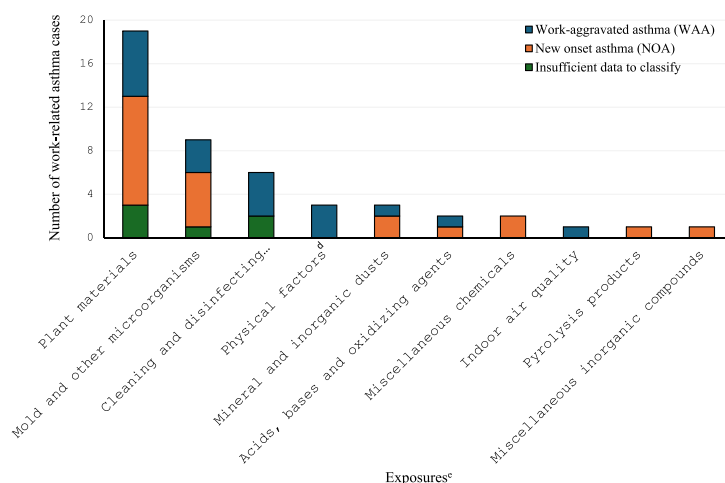


FIGURE 1. Number of work-related asthma cases in the cannabis industry by exposure source and work-related asthma classification (n = 47) ^aYear of cannabis legalization: California—medical (1996), recreational (2016); Massachusetts—medical (2012), recreational (2016); Michigan—medical (2008), recreational (2018); Washington—medical (1998), recreational (2012). ^bTotal exceeds 30 because each case may be associated with up to five putative agents (n = 47). ^cEighteen (94.7%) of cases reported exposure to marijuana plant and/or cannabis dust (marijuana and hemp); 1 case reported exposure to pollen. ^dPhysical factors comprise of humidity (n = 1), cold (n = 1), and heat (n = 1). ^eAOEC exposure codes as of January 2024.

acid.^{23,33} Additional respiratory hazards include endotoxin, ozone, cleaning materials, volatile organic compounds, and pesticides.^{11–13}

In general, WRA is underrecognized and underdiagnosed by health care providers, but there are additional, unique challenges related to diagnosing a work-related cannabis allergy.³⁴ Personal use of cannabis as well as the occupational exposure must be taken into account when allergic sensitization is observed.¹⁵ Occupational exposure of cannabis is likely to be in far excess of exposure compared with personal use, and types of exposure are different (e.g., personal consumption is very unlikely to cause exposure to fresh plant material).¹² Among the 16 workers with WRA where information about their personal use of cannabis was known, 81.3% recreationally used cannabis, although no information was available if use was via inhalation and/or oral ingestion. Strain differences may influence the amount and type of allergens present so that some individuals can develop reactions to specific strains but not to others.¹³ Currently, there are no commercially available allergy tests to assist in the diagnosis of cannabis allergy, and skin prick testing to slurries containing plant material is not widely performed. In addition, workers may be unwilling to seek medical assistance or report potential work-related exposure to their health care provider due to legal and ethical concerns regarding cannabis.

Our finding that only 46.7% of workers with WRA in the cannabis industry were known to have filed for WC benefits, to which they may be entitled, is consistent with previous literature that workers with WRA are unlikely to apply for WC.^{35,36} WC claims could cover medical diagnosis and care, medication, lost wages, vocational retraining, disability, and survivor benefits. There are known barriers to filing a WC claim; workers may be unaware or without access to their WC system, have fear of retribution or job loss, be dissuaded by their employer from filing, be unable to take time off work, believe WC will not accept their claim, or have other concerns or obstacles when filing a WC claim.^{35,36} However, the denial of benefits for 50% of known claims is of concern and may be due to insufficient clinical diagnosis and the underrecognition of hazards within the cannabis industry. Increased understanding of barriers in filing WC claims and receiving benefits by both workers and health care providers is needed.³⁵

The WRA cases described in this article are likely just the “tip of the iceberg,” indicative of a larger problem, given underrecognition of WRA by health care providers and the case-based nature of the surveillance systems in the four states. Also, it is worth noting that additional workers with work-related respiratory symptoms have been identified through state-based surveillance, although they did not meet the surveillance case definition for WRA. Exposures in the cannabis industry have been implicated in a wider potential spectrum of work-related upper and lower respiratory disorders, including allergic rhinitis and acute and chronic bronchitis.^{10,12,28,37}

Limitations

Limitations of state-based WRA surveillance have been previously discussed.^{1,17–22} The number of WRA cases identified to date through state-based surveillance likely underestimates the true burden of WRA in cannabis workers, and cases ascertained may not be representative of all WRA cases in the underlying population. Additional studies have found only 7% of adult asthma patients at a Health Maintenance Organization with NOA had documentation in their medical records, indicating that their health care provider asked about workplace exposures.³⁸ In this and a second study, only 14.7% of adults with asthma had discussed whether their asthma could be work-related with their health care provider.^{38,39} Especially in cases of delayed symptoms and onset of disease, clinical diagnosis of WRA may be challenging due to the difficulty of linking workplace exposures with asthma.⁴⁰ Furthermore, despite health care providers being legally mandated to report WRA in the four states—California,

Massachusetts, Michigan and Washington—there are suspected high rates of underreporting.^{19,35}

In addition, workers who develop diseases that do not have easily distinguishable symptoms or have long latency periods may not recognize that they are sick or sick enough to require care. For workers who do realize medical care is needed, they may forgo treatment due to not being able to pay for care and may not expect health care costs to be covered by WC. Also, some workers may not have sufficient time or ability to seek care.³⁵ These workers are likely to not be captured in our surveillance systems.

No specific antigen challenge testing or specific IgE testing is available as a part of standard medical practice to identify exposure (s) in the cannabis grow industry that might be causal factors. Identification of exposures, therefore, relies on self-report by the patient.

Also, data on WRA cases in the cannabis industry may have missing information due to reporting source and whether the case was interviewed. For cases that were not interviewed, information such as race/ethnicity and personal use of cannabis may be missing if it was not provided by the reporting source; some results may need to be interpreted with caution.

Prevention

Research-informed strategies to mitigate hazards in the cannabis industry, with a particular focus on understanding the prevalence and risk factors associated with OA and allergies, are needed. The occupational safety and health hierarchy of controls is a framework to understand the relative effectiveness of risk reduction strategies.⁴¹ Starting with the most effective strategy of elimination, steps to eliminate exposure to hazards, such as mold and disinfectants, can be taken. Mold growth can be minimized or eliminated through cultivation practices and environmental controls. Disinfectants formulated with asthma sensitizers such as sodium hypochlorite (bleach), benzalkonium chlorides, and mixtures of hydrogen peroxide and peroxyacetic acid can be replaced with disinfectants not implicated to cause WRA. Exposure to the cannabis plant itself cannot be eliminated; however, a job hazard analysis can be performed to identify processes with high dust exposure and prioritize prevention efforts.⁴² To control plant dust, engineering controls such as local exhaust ventilation on high dust generating equipment, adequate room ventilation, and air filtration can be implemented.⁴¹ Direct application of a disinfectant reduces the inhalation exposure to users and to others in the work area as compared with application by fogging. Administrative controls such as limited personnel access to high dust areas, dust cleanup with HEPA vacuums and no dry sweeping, and worker training are important.⁴¹ Workers should be informed of workplace hazards and taught to recognize respiratory hazards and associated health symptoms.⁴³ Finally, personal protective equipment for skin, eye, and respiratory protection can be implemented. During or after implementation of engineering controls, respirators such as filtering facepiece respirators (N95) or elastomeric respirators can be used for additional protection. If respirators are required by the employer following a hazard control evaluation, in the United States a full respiratory protection program that includes medical evaluation, training, and fit testing is needed.^{41,42,44}

Early recognition of WRA is crucial to preventing deaths such as the two described in the California and Massachusetts cannabis industries and reducing the long-term morbidity among workers who develop WRA. The best way to ensure early recognition is for employers to institute a medical surveillance program that provides clinical evaluation for early signs and symptoms of respiratory disease and if signs and/or symptoms are noted provides for the necessary job reassignment or medical removal to reduce WRA morbidity and mortality.^{5,45}

In addition to an employer's responsibility to provide a safe workplace, health care providers play an important role in protecting public health. It is critical for health care providers to inquire about

the work-relatedness of symptoms, even those that are mild, because ocular, dermal, and nasal allergic symptoms can be precursors to respiratory disease, and asthma may progress in severity and even lead to death.⁵ Asthma fatalities highlight the underrecognition of WRA and the role that health care providers play as key partners in prevention.⁴⁶ It is important to educate health care providers on WRA and respiratory hazards in the cannabis industry to improve diagnoses and treatment for industry workers.

CONCLUSION

The legalization of medical and recreational cannabis has led to a new workforce with emerging work-related hazards. The surveillance data and four case reports presented here document additional evidence of WRA in the cannabis industry stemming from exposure to cannabis plant dust, bioaerosols including mold, and cleaning and disinfecting chemicals. As of this writing, there are two known asthma-related fatalities among workers in the US cannabis industry following exposure to cannabis dust, one previously reported, and one newly reported here. Information from the cases identified in state surveillance systems highlights the need for tailored intervention efforts by employers, health care providers, and occupational safety and health professionals to address the hazards in this industry.

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