

Supplemental Digital Content 1: Examples of Work-Related Asthma Cases within the Cannabis Industry

Case 1. California – Inventory specialist (new-onset) – *Fatality*

A man in his 20's worked in a large warehouse where cannabis was stored, ground, and packaged to be sold in the company's dispensaries. The warehouse and one of the dispensaries were part of the same large building but were completely separated by a solid wall. There was no growing onsite, but rather the warehouse received large amounts of dried inventory from outside growers. He had recently received a promotion to 'inventory specialist' where his job entailed receiving large plastic containers of product, opening them and stirring them up to 'aerate' them, lifting the lids to 'burp' them, and getting their contents ready to be packaged. All products were sent to the lab for testing (per California law), and he was solely responsible for destroying the product that failed testing. There was a manufacturing operation about 100 feet away in the same warehouse, where dried cannabis was ground and packed into pre-rolled joints. In the past he also did more packaging, but he did less of that after his promotion.

He never had breathing problems before working for the company but grew up around cannabis being grown and had worked for two smaller cannabis companies previously, all without much contact with raw product. After working at his current company for a few months, he developed shortness of breath and wheezing. He used his mother's albuterol inhaler to self-treat his respiratory symptoms and did not seek medical care. As his symptoms increased, he used his mother's albuterol inhaler more frequently, eventually needing it multiple times a day. He stopped smoking cannabis when his breathing problems began and started using edibles. He never smoked tobacco. After a year and a half of working there, he took six weeks of paternity leave, where he

rarely needed the inhaler and his symptoms markedly abated. Within a week of returning to work after his leave, his symptoms of wheezing and shortness of breath returned. Approximately two months later he collapsed at work with an asthma attack and died. He had an appointment scheduled to see his mother's asthma physician for the week after he died. He had a co-worker who did similar work and also had breathing problems and went out on paternity leave around the same time—however, when his breathing problems improved on leave, he opted not to return to the work environment. The company has since discontinued the grinding and packaging operation. Dried products arrive in sealed bags and are shipped to other companies that manufacture products.

Case 2. Massachusetts – Processing agent (work-aggravated)

A man in his 20's experienced shortness of breath, cough, wheezing and chest tightness within one month of starting work at an indoor cannabis cultivation and processing facility. His symptoms worsened throughout the work week and improved when he was away from work. He had had asthma since childhood that was well-controlled, only occasionally experiencing symptoms prior to starting this job. Within four months of starting at the facility, he sought emergency room care four times for his symptoms.

His job as a processing agent involved handling and breaking down harvested plants, preparing edibles for packing, and cleaning and disinfecting machines. He reported that breaking down harvested plants was particularly problematic, as fine plant material/cannabis dust was generated and released into the air. The worker estimated that between 10 and 30 other individuals did similar work or had similar exposures.

He requested a respirator shortly after starting employment, which his employer did provide, but he found it hard to breathe while wearing it and it fit poorly at times. He was seen by an

occupational medicine physician, who suspected work-aggravated asthma from on-the-job exposure to cannabis dust and mold, prescribed him medication and recommended that he transfer jobs. His employer reassigned him to an entry level job in a different area, but he still had to attend regular meetings in his original work area. The worker viewed his reassignment as a demotion, and while it resulted in reduced asthma symptoms, his symptoms were still worse than prior to starting at the facility.

The physician reported the case to the Massachusetts Department of Public Health (DPH), as required by state public health regulations. DPH interviewed the worker, confirmed that he had work-aggravated asthma and referred his case to the regional office of the U.S. Occupational Safety and Health Administration (OSHA), which conducted an investigation. OSHA found the employee had an asthma attack triggered by either cannabis flower kief dust or isopropyl alcohol. A particular strain of cannabis was suspected by the employer to have caused the worker's asthma exacerbation, and there were concerns it was causing respiratory issues and dermal rashes among other workers as well. In response, the employer took the strain out of production, tracked adverse health effects of the remaining cannabis strains, and moved the trimming process to a room with improved ventilation.

Case 3. Michigan – Cultivation technician (new-onset)

A woman in her 40's developed wheezing, chest tightness and shortness of breath one year after beginning to work as a cultivation technician at an indoor cannabis growing facility. Her symptoms began after going into the grow room where a hydrogen peroxide/peracetic acid disinfectant was being sprayed. When she was interviewed five months after the acute exposure to the disinfectant,

she continued to be symptomatic with improvement in her symptoms on weekends and vacations. She was started on montelukast and an albuterol inhaler. She was also concerned about mold growth in the building. The disinfectant continued to be used and she stated her symptoms were worse and she had to take more medication. She had not sought care at an emergency department and had not been hospitalized.

She had quit smoking cigarettes 10 years previously after smoking less than quarter pack of cigarettes a day for 22 years. She had asthma as a child until the age of 11. She had a sibling with asthma. She did not file for workers' compensation. At the time of the interview, she had not had any breathing tests but stated her doctor wanted her to be tested. Prior to her current job she was a cultivation technician for one year at a different indoor cannabis growing facility. At that facility she had nosebleeds after exposure to a different brand of a hydrogen peroxide/peracetic acid disinfectant.

Case 4. Washington – Processor (new-onset)

A woman in her 40's with a past medical history of seasonal allergies and childhood asthma presented with work-related cough, wheezing, chest tightness and shortness of breath. She had been working at an outdoor cannabis growing facility for approximately 2 months prior to presentation. She routinely used cannabis recreationally but denied a prior history of home or occupational cannabis cultivation. Her initial job duties were outdoors, planting cannabis seedlings and assisting in the harvest. Her symptoms did not begin until she was transferred to work indoors as a cannabis processor in a converted warehouse. In this role, she prepared dried and cured cannabis for processing into joints and other consumer products. She removed dried

plant from a large plastic tote to manually destem and trim, which created a significant amount of aerosolized dust material. Per patient report, there was poor ventilation in her area and no required respiratory personal protective equipment.

Approximately 2 days after she started working indoors as a processor, she noticed onset of an itching, erythematous rash that extended up to her forearms and was described by the patient as hives. When she was transferred to outdoor job duties the following week, her symptoms resolved. She subsequently was moved back into the indoor processing facility and developed asthma-like symptoms. Her respiratory symptoms escalated through the workday and were specifically related to tasks as a processor. She was seen in urgent care on multiple occasions with normal chest radiographs and prescribed corticosteroids and bronchodilators. She opened a worker compensation claim, and per the patient, her employment was terminated the following day.

Approximately 6 months after leaving the cannabis farm, the patient was evaluated by a pulmonologist and occupational medicine physician. Pulmonary function tests showed a non-specific mild reduction in air flow with FEV₁ 76% of predicted, normal FEV₁/FVC ratio and flow volume loop. Although she had no significant bronchodilator response, she had borderline air trapping with residual volume 119% predicted. She was initially maintained on an inhaled corticosteroid and long-acting beta agonist with a short-acting bronchodilator as needed. Over time, her symptoms decreased and she felt that she had returned to 75-80% of baseline by two years after her exposure.