

# Pilot study of Respiratory Exposures and Health

- Workplace #1
  - Tier 3 indoor grow using conventional (non-organic) methods.
  - Seasonally purchases outdoor-grown cannabis from other growers, which they then process into consumer products.
  - 45 workers; 31 participated in study
- Workplace #2
  - Tier 2 indoor grow using organic (pesticide free) methods.
  - 20 workers; 11 participated in study



# Exposure measurements

- Area based sampling in four task zones
  - Grow rooms
  - Trim area
  - Pre roll
  - Office (referent area)
- Particulate matter
  - Full shift measurements at each task location using Dylos DC110 pro
  - Optical particle counter, 4 size bins: (0.5-1 $\mu$ m, 1-2.5 $\mu$ m, 2.5-10 $\mu$ m, >10 $\mu$ m)
  - Measured particle number conc.; mass conc. and size distribution
- Sum of 21 Terpenes (integrated sample, sorbent tube & GC/MS)
- Total VOCs (continuous PID)





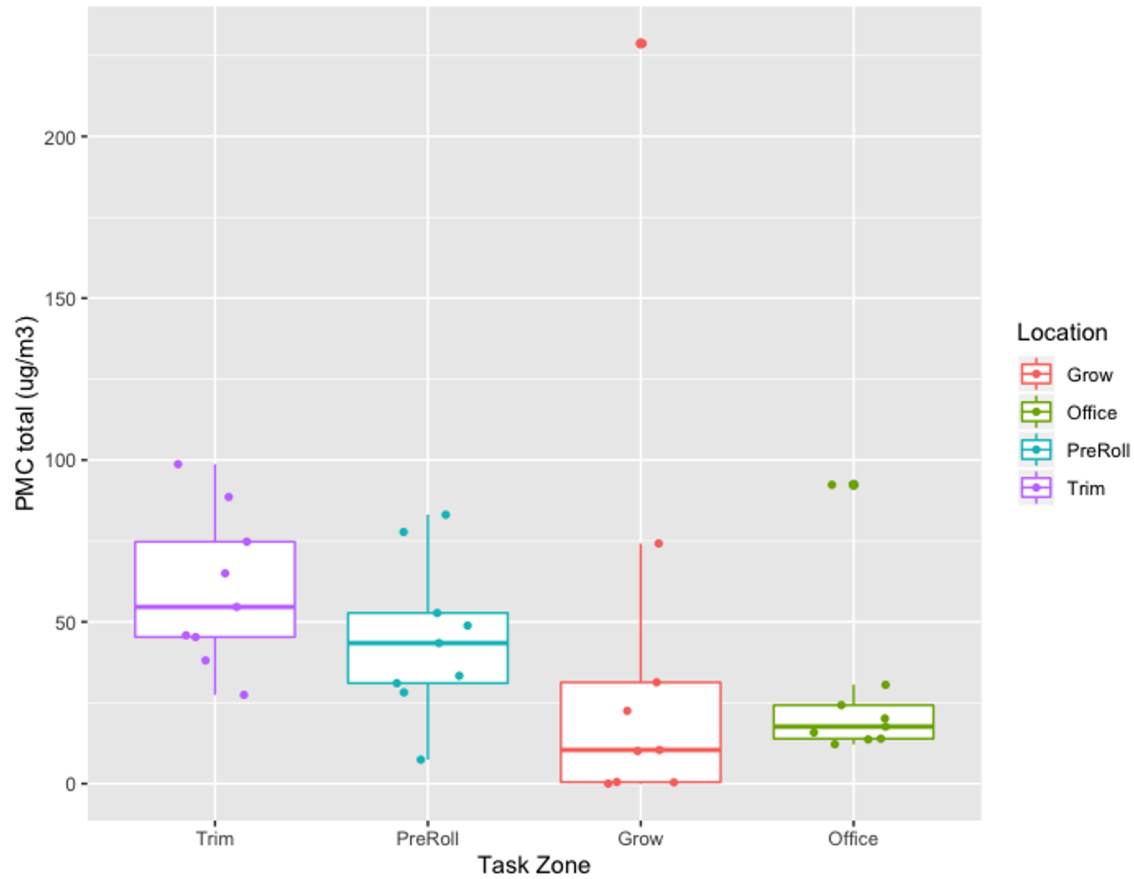
# Exposure Results



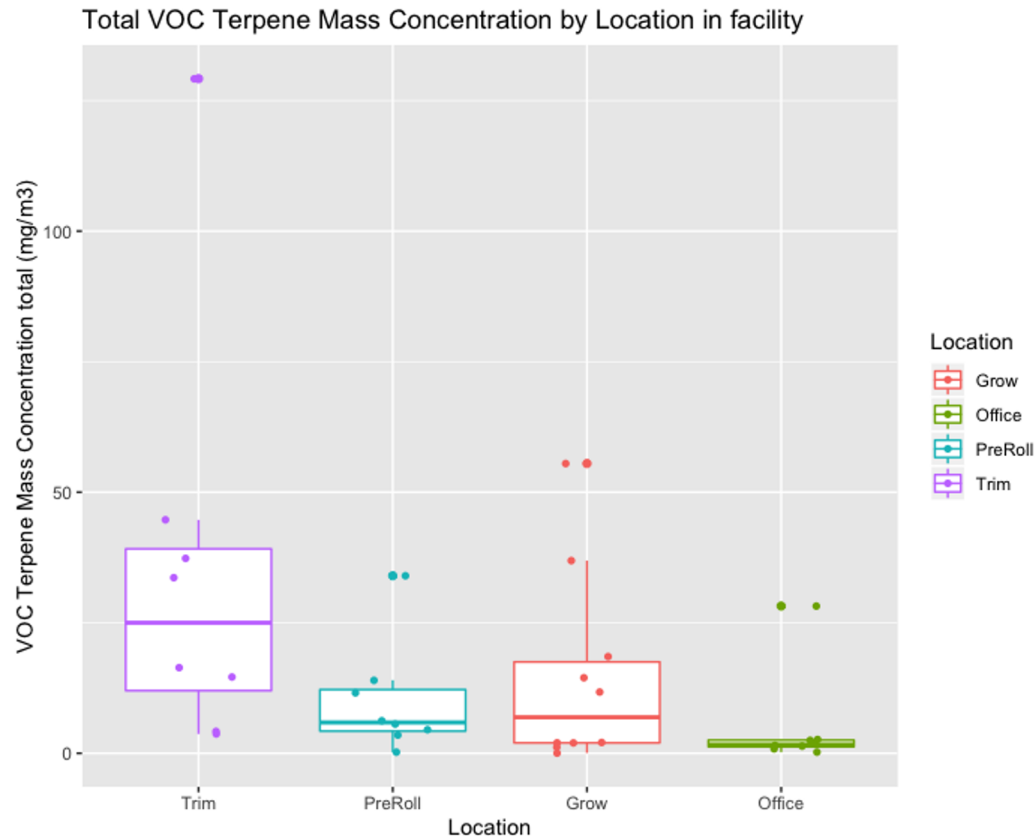
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# Particle Mass Concentrations

Total PMC by Task Zone in facility



# Terpene Measurements



# Marijuana and Work-Related Asthma

Work-related asthma is a lung disease caused or made worse by exposure to substances in the workplace. Legal industrial-scale marijuana (*Cannabis sativa*) processing has highlighted a connection between plant dust inhalation and a risk for work-related breathing problems.

Dust from many parts of the marijuana plant (leaves, buds and stems) as well as pollen and smoke are associated with allergic reactions. Common examples of allergic reactions include asthma, rash, and a few case reports of anaphylactic shock.<sup>1</sup> Work-related asthma has been reported in cannabis laboratory workers.

In addition to the marijuana dust itself, industry workers are exposed to other asthma-causing substances such as mold, pesticides, soil components, ozone, and cleaning chemicals.



*Cannabis sativa*

## Workers may:

- Have a hard time breathing with wheeze, cough, and chest tightness
- Get asthma symptoms from ongoing everyday exposure or from a one-time upset event
- Develop asthma even though they have been around a substance for years
- Improve their health if they stop being around the asthma-causing substance early enough

## Workers at risk include:

- Growers, production workers, extract manufacturers, and retail stockists
- Marijuana laboratory and research staff
- Police and drug enforcement officers

## Recommendations

- Tell your employer if you feel shortness of breath from work.
- Talk to your doctor about your health symptoms and your job.
- Consult a safety and health professional to help with ventilation, respiratory protection, and protective clothing.
- Washington employers can request a free and confidential [L&I Consultation](http://lni.wa.gov/safety/consultation) (lni.wa.gov/safety/consultation).

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# Inhalational Exposures in Cannabis Workers



<b>Bioaerosols</b>	Organic dust Fungi and mycotoxins Bacteria and endotoxin Insects and mites
<b>Chemicals</b>	Pesticides and fungicides Fertilizers Cleaning products
<b>Irritant gases and vapors</b>	Cannabinoids Terpenes and other volatile organic compounds Carbon dioxide Carbon Monoxide Ozone
<b>Cannabis allergens</b>	Can s2: Profilin Can s3: Non-specific lipid transfer protein (nsLTP) Can s4: Oxygen-evolving enhancing protein 2 (OEEP2) Can s5: Pathogenesis related protein 10 homologue



# Emerging Spectrum of Respiratory Disease in Cannabis Workers



<b>Respiratory disease</b>	Upper Airway	<i>Allergic rhinosinusitis</i>
	Lower Airway	<i>Irritant induced asthma</i> <i>Sensitizer induced asthma</i> Byssinosis Allergic bronchopulmonary aspergillosis Chronic bronchitis COPD
	Parenchymal	Hypersensitivity pneumonitis
<b>Dermal disease</b>		<i>Irritant contact dermatitis</i> <i>Sensitizer contact dermatitis</i>
*Diseases in italics have been reported in workers with occupational exposure to cannabis		





Nov. 2, 2022, 2:30 AM

# Cannabis Worker's Death Triggers Closer OSHA Industry Scrutiny

## DEEP DIVE



**Bruce Rolfsen**

Reporter



- 
- Worker death linked to cannabis dust-induced asthma
  - OSHA says pot dust is a chemical hazard to workers
  - [In Focus: Cannabis](#) (Bloomberg Law subscription)

### Documents

- [OSHA hazard alert letter](#)
- [OSHA citation](#)

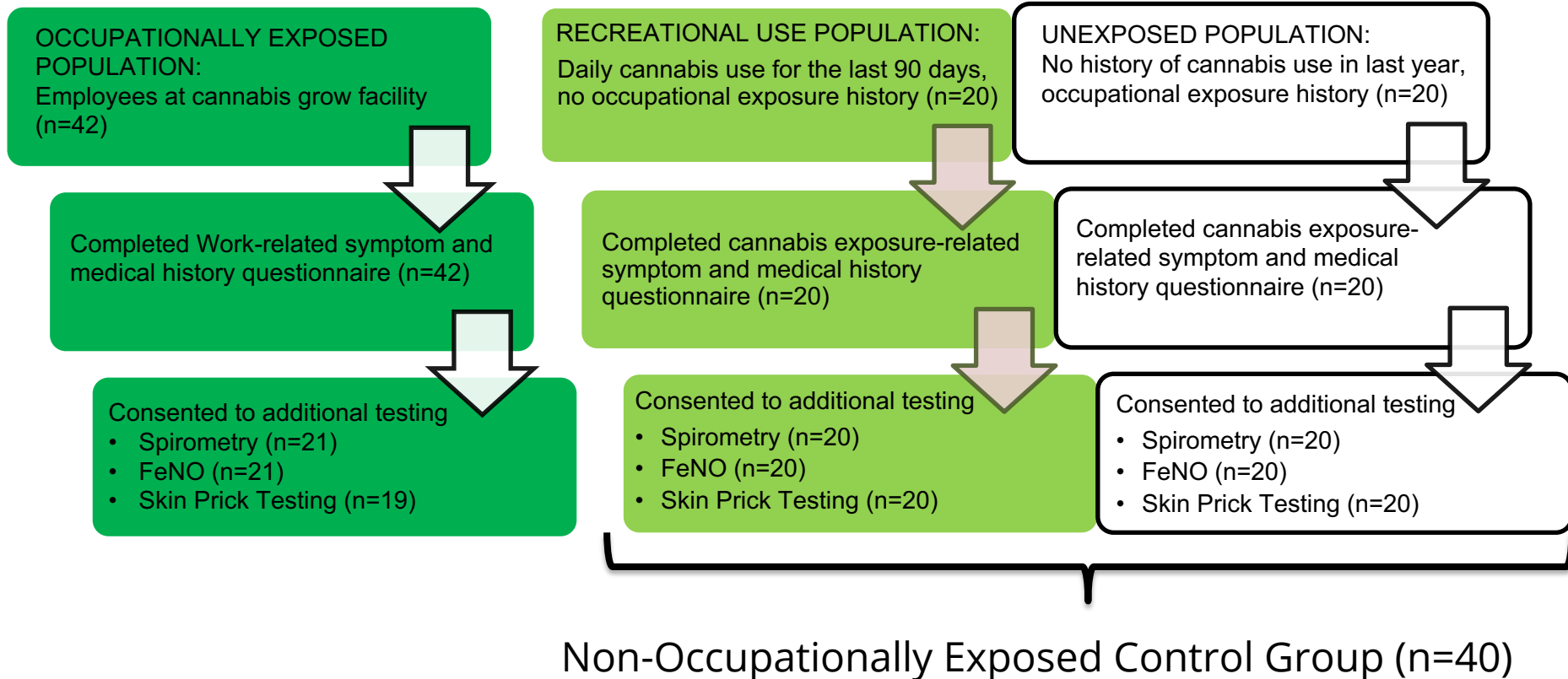
<https://news.bloomberglaw.com/safety/cannabis-workers-death-triggers-closer-osha-industry-scrutiny>



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# Cross-Sectional Study Design



# Health Measurements and Outcomes

# W

**Health Symptoms:** dermal, ocular, nasal, respiratory

## FeNO

- Continuous Outcome
- <25 ppb □ Normal



NIOX Vero ([www.niox.com](http://www.niox.com))

## Spirometry

- Continuous Outcome
- FEV1 % predicted



EasyOne Air ([www.nddmed.com](http://www.nddmed.com))

## Skin Prick Testing

- Binary Outcome (+ / - to hemp or cannabis)
- PNW Mold Strains
- Cannabis strains
- Hemp
- Cat dander
- PNW grasses
- Dust mites
- Histamine
- Saline



# Statistical Analyses

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- > Cannabis exposure status -> occupational vs non-occupational
- > Multivariable linear regression:
  - FeNO: log-transformed for normality
  - FEV1% predicted
  - Confounders: recreational cannabis use, tobacco use (both); age, sex, height, atopy history (FeNO only)
- > Multivariable logistic regression:
  - Allergic symptoms on health questionnaire: ocular, nasal, dermal or respiratory; sensitization to cannabis on SPT
  - Confounders: recreational cannabis use, age, sex, ethnicity, medical history, history of atopy, tobacco smoking



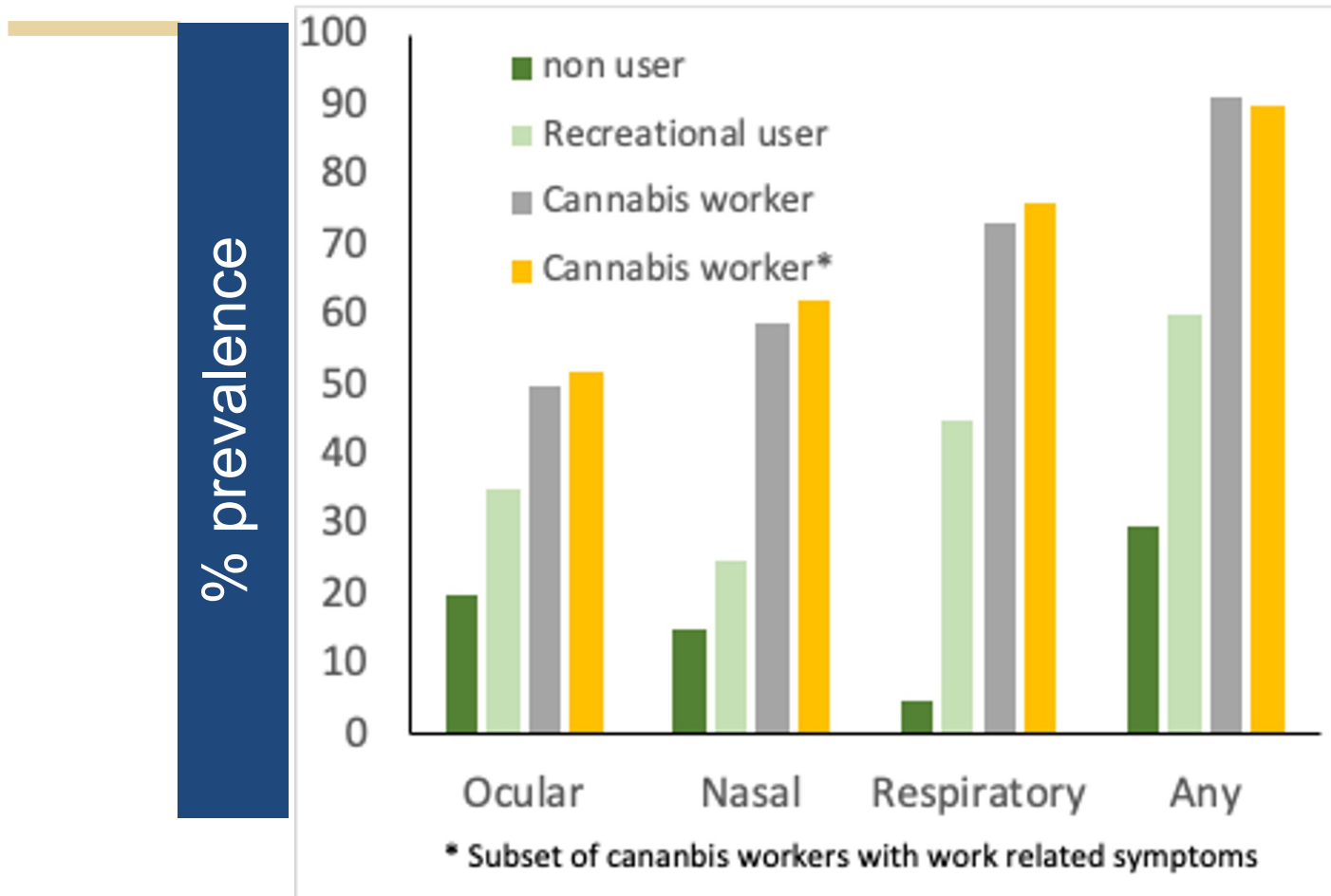
# Baseline Characteristics of Participants in Non-Occupational Exposed and Occupationally Exposed Cohorts



	Non-Occupationally Exposed Control Group		Cannabis Workers	
	Recreational Non-users (n= 20)	Recreational users (n=20)	Cannabis employees (n= 42)	Employees with work-related symptoms (n=21)
<b>Male</b> (n, %)	5 (15)	8 (40)	23 (55)	11 (52)
<b>Non-Hispanic White</b> (n, %)	14 (70)	12 (60)	33 (80.5)	16 (80)
<b>Age</b> (years, SD)	37 (16.6)	35 (12)	32 (8.4)	32 (11)
<b>Atopy</b> (n, %)				
Asthma	2 (11)	5 (25)	9 (21.4)	3 (14)
Hay Fever	2 (11.8)	4 (20)	11 (26.2)	4 (19)
Eczema	2 (12.5)	3 (15)	10 (23.8)	2 (9.5)
<b>Tobacco Use</b> (n, %)				
Current	0 (0)	2 (10)	17 (40.5)	10 (48)
Past	3 (15.8)	6 (30)	12 (28.6)	3 (14)
Never	17 (85)	12 (60)	13 (31.0)	8 (38)
<b>Cannabis Use</b> (n, %)				
Current	0 (0)	20 (100)	41 (97.6)	21 (100)
≥ Daily	-	13 (64.7)	34 (81.0)	17 (80)
Weekly	-	7 (35.3)	4 (9.5)	2 (9.5)
≤ Monthly	-	0 (0)	3 (7.1)	2 (9.5)



# Prevalence of symptoms by exposure group



# Risk of symptoms in association with occupational exposure to cannabis

	Odds ratio of health symptoms (last 12mths) with occupational exposure	p-value
<b>Dermal Symptoms</b>		
Unadjusted	3.60 (1.03, 12.33)	<b>0.04</b>
Adjusted	6.95 (0.97, 50.0)	<b>0.05</b>
<b>Nasal symptoms</b>		
Unadjusted	4.00 (1.50, 10.7)	<b>0.006</b>
Adjusted	3.21 (0.80, 12.79)	0.10
<b>Ocular symptoms</b>		
Unadjusted	1.98 (0.78, 4.99)	0.15
Adjusted	1.23 (0.35, 4.32)	0.75
<b>Respiratory Symptoms</b>		
Unadjusted	6.69 (2.54, 17.6)	<b>&lt;0.001</b>
Adjusted	2.11 (0.59, 7.52)	0.25
<b>Any allergic symptom</b>		
Unadjusted	7.33 (2.53, 21.3)	<b>&lt;0.001</b>
Adjusted	5.43 (1.04, 28.3)	<b>0.04</b>
Adjusted for recreational cannabis use, tobacco smoking status, age, sex, history of atopy		



# Risk of cannabis allergy in association with occupational exposure to cannabis

	Odds ratio of Cannabis/hemp sensitization with occupational exposure	P-value
<b>Unadjusted</b>	19.5 (2.2, 172.8)	<b>0.008</b>
<b>Adjusted</b>	8.84 (0.93, 84.1)	0.06

\* Adjusted for recreational cannabis use, history of atopy





## Association between airway inflammation and occupational exposure to cannabis

	Change in F <sub>E</sub> NO with occupational exposure	p-value
% change in F <sub>E</sub> NO		
Unadjusted	42% (3, 95)	0.03
Adjusted	49% (1, 120)	0.04
*Adjusted: recreational cannabis use, tobacco smoking status, height, sex, age		



# Conclusions

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**Compared to recreational users and non-users,  
Occupationally Exposed Cannabis Workers have:**

- Significantly increased odds of respiratory and allergic symptoms
- Significantly increased Fractional Exhaled Nitric Oxide
- Higher prevalence of sensitization to Cannabis on skin prick testing
- A trend toward decreased pulmonary function measures

