Cannabis Industry Occupational Hazards: Presentation Outline

- Background
  - Cannabis Industry and Workers in California

- Occupational Hazards and Health Effects
  - Respiratory and Dermal Exposure
  - Explosions and Fires
  - Repetitive Strain
  - Physical Hazards
  - Workplace Violence

- Conclusions
Background

Cannabis Industry and Workers in California
California Regional Production

About 8 million pounds in North Coast and North Mountains

About 3 million pounds in the Central Valley

About 2 million pounds in the Central and South Coastal regions with most California population

Source: ERA Economics
CalCannabis: Types of Cultivation Sites

1. Outdoor Cultivation
   Without the use of light deprivation and/or artificial lighting in the canopy area

2. Indoor Cultivation
   Artificial light at a rate greater than 25 watts per square ft.

3. Mixed-light Cultivation
   Light deprivation and/or artificial lighting below a rate of 25 watts per square ft.

4. Nursery Cultivation
   Clones, immature plants, seeds
Cannabis Production

Planting, Cultivation, Harvesting
Post-processing (1)

Drying

Destemming

Hand trimming

Trimming table in a processing plant

Trimming table in a farm

Hand trimming
Post-processing (2)

Destemming Machine

Trim Machine

Trim Machine
California Cannabis Workers

Estimated *FTE workers:  
- Outdoor 127,000  
- Indoor 40,000  
- Mixed light-greenhouse 30,000  
  TOTAL ~197,000

Cultivators: full-time workers, traditionally young, white, male

Trimmers / processors: part time - seasonal.

* FTE = full-time equivalent with 2,000 hrs/year.

Source: ERA Economics
Cannabis Farm and Processing Locations

- Major production has been in small, remote, rural locations, esp. in Northern California
- No registry and illegal status further compound challenge of obtaining representative health data
- No large studies of worker populations, as in other production ag
- Much of health risk conclusions based on limited data, inference from other ag health data
Traditionally immigrants, foreign vacationers, college students, young working professionals. With more industrial production, changing to labor contractors in processing facilities, often with older female workers.
California Cannabis Industry Licensing and Regulation

- Bureau of Cannabis Control: Testing laboratories
- Cal Cannabis Cultivation, CDFA: Any cultivation activity
- Manufactured Cannabis Safety Branch: Extraction, infusion, packaging
- Dept. Pesticide Regulation: Pesticide handling, residue
- California EPA: Environmental impacts
- California OSHA: Workplace safety and health
Methods

- Literature Review
  - Media, academic and industry research, official aggregate data

- Site Visits & Key Interviews
  - 3 outdoor growing facilities
  - 2 indoor growing facilities
  - 1 extraction facility
  - 1 distribution facility (for cannabis extraction equipment)
  - 1 processing plant (under construction)
Cannabis Industry Occupational Hazards

- Respiratory & Dermal Exposures
  - Allergens
  - Chemical exposures
  - Microbiological exposures

- Musculoskeletal Disorders (Ergonomic Risks)

- Physical Hazards
  - Electrical Hazards
  - Cuts, abrasions, etc.
  - Compressed gas explosion, fire

- Workplace Violence
  - Robbery, assault
Respiratory Health Hazards in Agriculture

American Journal of Respiratory and Critical Care Medicine
November 1998 Vol 158 Number 5, Part 3

Supplement: Respiratory Health Hazards in Agriculture

...American Thoracic Society
National Institute for Occupational Safety and Health

Available on line at: www.intl.atsjournal.org

Respiratory Hazards in Agriculture

**EXPOSURE**

- Organic dusts
  - Vegetable: Grain, hay, cotton
  - Animal: Hair, feathers, skin, dander
  - Microbial: Bacterial and fungal antigens, endotoxin

- Gases: $\text{H}_2\text{S}$, $\text{NH}_3$, $\text{CH}_4$, $\text{CO}_2$, $\text{NO}_2$

- Chemicals: Paraquat, solvents, fuels, exhausts

- Inorganic dust: Silica, silicates, asbestos
Agricultural Associated Airway Disorders

- Upper Airway Responses
  - Nasal to larynx (inflammatory responses from organic dusts, gases and pesticides)

- Asthma and Asthma-like syndrome
  - (allergic v non-allergic, similar symptoms; reversible)
  - May eventually lead to Chronic Obstructive Airway Disease

- Gas Inhalation
  - (discussed after biological exposures)
Odds Ratios* for Respiratory Symptoms by Percent Time at Dusty Job, CA farmers

Schenker, JOEM, 2006

*Logistic regression, adjusted for age, smoking status, gender and other variables
Age-Adjusted Prevalences for Chronic Conditions: NHIS

Brackbill, AJE, 1994
Occupational Asthma

- Exposure to workplace airborne irritants, allergens
  - organic dusts examples include hay, mites, animal dander, endotoxin, gases (ammonia) and pesticides

- Asthma symptoms of chest tightness, chronic cough, wheeze and/or shortness of breath.

- Airway inflammation

- Worsen existing asthma

- Without treatment becomes chronic
Examples of Agents in Agriculture Causing Occupational Asthma

- **Plant-derived**
  - Cereals
  - Grain dust mites
  - Soya bean dust
  - Coffee dust
- **Animal-derived**
  - Cow dander, urine
- **Arthropod-derived**
- **Other**
  - $\text{NH}_3$, NO$_2$ (high concentrations)
  - Pesticides (?)
Agricultural Respiratory Disease: Asthma-like Syndrome

- Acute non-allergic airway response from inhalation of agents in ag environment.
- Symptoms of chest tightness, wheeze and/or dyspnea.
- May be cross-shift decline in FEV$_1$ (<10%).
- Airway inflammation; PMNs, cytokines.
- Transient increase in airway responsiveness.
- Dose-related effects.
- Self-limited inflammatory event.
Interstitial (non-airway) tissue affected

- Organic Dust Toxic Syndrome (ODTS)
- Farmer’s Hypersensitivity Pneumonitis (Farmer’s Lung)
- Interstitial Fibrosis
Organic Dust Toxic Syndrome (ODTS)

- Exposure to moldy dust - containing endotoxins, fungi, mycotoxins, bacteria – example cotton dust
- Acute inflammatory condition of airways and alveoli.
- Symptoms: fever, flu-like, coughing, aching, headache, lethargy
- Systemic symptoms peak 4-8 hrs. after exposure.
- Not due to hypersensitivity.
- Self-limited, excellent prognosis.
Hypersensitivity Pneumonitis

- Sensitization to repeated inhalation of dusts containing fungal spores
- Causes inflamed alveoli in the lungs which may scar
- Symptoms: allergic reaction
  - Acute: flu-like fever, chills, joint pain, headache, cough – occur within 9 hours of exposure
  - Chronic: bronchitis, cough, shortness of breath, fatigue, weight loss, can lead to irreversible lung damage
Agricultural Lung Disease: Infections

<table>
<thead>
<tr>
<th>Category</th>
<th>Examples</th>
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</thead>
<tbody>
<tr>
<td>Bacteria</td>
<td>Anthrax, brucellosis, leptospirosis, pasturellosis, psittacosis, Q fever, streptoccal.</td>
</tr>
<tr>
<td>Mycobacteria</td>
<td>M. Tuberculosis, M. Bovis</td>
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<tr>
<td>Fungi</td>
<td>Aspergillosis, coccidiodomycosis, cryptococcis, histoplasmosis,</td>
</tr>
<tr>
<td>Viruses</td>
<td>Hantavirus, swine influenza</td>
</tr>
<tr>
<td>Parasites</td>
<td>Ascariasis, dirofilariasis, echinococcosis, paragonimiasis</td>
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Cannabis Production: Respiratory and Dermal Exposures

- **Allergens**
  - C. sativa, THC (delta-9-tetrahyrocannabinol)

- **Chemical Exposures**
  - Pesticides, Rodenticides, Fungicides, Insecticides, Corrosive materials in plant amendments

- **Microbiological Exposures**
  - Endotoxins, Bacteria, Fungi (including mold), predatory mites
OSHA - no indoor or outdoor occupational microbe air contamination rules

- **Endotoxin**– fragmented (dead) Gram neg bacteria
  - *Outdoor facility tested in WA - airborne concentrations lower than European recommended limits (90 EU/m³)
  - **Indoor hemp processing plant – 1,900 EU/m³ – high, health effects likely – similar in other greenhouse crops

- **Microbial**
  - *Outdoor facility found bacteria which cause respiratory health effects (asthma, ODTs, HP, chronic bronchitis). Levels below those found in animal feeding operations.

Known Respiratory Hazards in the Cannabis Industry (2)

*Outdoor facility – only relative abundance collected in one facility

• Predominantly *Botrytis cinerea* - grey mold in *Cannabis sativa*

**Indoor facilities may have total concentrations ≥ (1 x 10^5) spores per m³ air – likely harmful with prolonged exposure

*Couch et al (2017); **Martyny et al (2012)
Indoor Conditions

- Potential for greater exposure to pesticides and concentrated chemicals than outdoors
- High humidity levels – promote mold growth
- Poor ventilation practices
Dermal Exposures: Effects

- Dermatological exposures to
  - THC (delta-9-tetrahydrocannabinol) commonly found on all surfaces where cannabis cultivated or processed
  - Fungi
  - Cannabis sativa vegetation
  - Corrosive materials in plant amendments

- Symptoms:
  - irritation or burns to skin
  - allergic dermatitis
    - Hives, itching, swollen eyes
Explosion hazard with compressed gases

Commercial extraction with liquefied gas under high pressure.
- CO$_2$
- Butane, propane
- Dichloromethane, naptha, benzene, methanol, ethanol, etc.

75% of production may go into extraction in some areas

Gases also used for controlling plant growth
Use of compressed gases in home extraction sites

Explosions are common with home extraction, most often from butane explosions and fires.
Explosions are Frequent with Cannabis Oil Extraction

2 charged in North County drug-lab explosion

Two cannabis labs explode in Mendocino County in four days

Boom goes the honey pot: Suspected marijuana-oil lab explodes in Santa Rosa

Man suffers major burns in Weston Ranch honey oil lab explosion

Here's the aftermath and arrest in Foresthill butane honey oil explosion
Ergonomics is the process of designing or arranging workplaces, products and systems so that people can work more efficiently and safely.

Ergonomic injuries may be referred to as Repetitive Stress Injuries (RSIs), Repetitive Motion Injuries (RMIs), Musculoskeletal Disorders (MSDs), Cumulative Trauma Disorders (CTDs).
Musculoskeletal Disorders

- Repetitive stress, Inadequate hand tools
  - Trimming
- Prolonged static postures
  - Sitting long hours
  - Work stations not organized ergonomically
- Forceful exertions
- Prolonged physical contact with hard work surfaces
Ergonomics of Cannabis Trimming

Trimming Table at a Farm

Trimming Table at a Processing Plant
Repetitive Hand Motion in Trimming

- Evaluation of Potential Hazards during Harvesting and Processing Cannabis at an Outdoor Organic Farm
- 4 employees
- The peak level cutting force estimates were low.
- More experienced workers were faster, more efficient.
Employees did not report any work-related symptoms.

Employees were concerned about repetitive hand motions from trimming cannabis.

Some hand trimming activities required a lot of hand motions, but not a lot of force.
“After a few weeks your hands are calloused, your lower back crippled, your wrists ache, and all the days merge into a green haze.”

Sera Higgs.
Matador Network,
July 20, 2016
Physical Hazards

- Heat Illness – outdoor and greenhouse exposures

- Electrical Hazards
  - Explosion, fire, exposed equipment

- Unsafe work environment
  - Ladders + heights
  - Safe footing + work space
  - Plant support entanglement
  - Lifting heavy materials
  - Entrapment
Workplace Violence

- Armed Robbery
  - Limited access to formal banking institutions – large amounts of cash on-site at workplace
  - Isolation

- Sexual Assault
  - Sex trafficking

- Lack of reporting due to illegal status and isolation
  - Precarious work status – immigrants without papers
Summary: Health and Safety

- Little data exists on actual risks
- Concern or limited data for:
  - Diverse respiratory hazards
  - Dermatitis
  - Allergic reactions
  - Repetitive stress injuries
  - Physical injury: cuts, strains, etc.
  - Explosion, fire
  - Infection: bacterial, fungal
  - Personal safety, esp for women
Summary and Recommendations

- Diverse occupational health and safety hazards exist for workers in cannabis growing and processing.
- Research is needed to better characterize exposures and health hazards.
- Resources should exist for this effort, in addition to product licensing, environmental and other regulatory efforts.
- The cannabis workplace should be a “safe and healthful workplace that is free from serious recognized hazards”. This is commonly known as the General Duty Clause of the OSH Act.
- Education and outreach programs are needed.
UC Davis Cannabis Study Team

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Thank You!

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