Cannabis Legalization and Environmental Health

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Current State of Cannabis Legalization

- Initial frameworks/intentions declared; legislation in the works
- *Proposed Approach to the Regulation of Cannabis*
  - Consultation open until January 20th, 2018
- Health Canada – focus groups for public education campaign
Risk Messaging for Cannabis

• Major themes:
  – Addiction; youth & cognitive development; mental health; motor vehicle accidents; pregnancy & breastfeeding
  – High-level public health concerns that may become apparent over time (surveillance and research).

• What about environmental health risks?
  – E.g., CO and WA: pesticide contamination and hash oil explosions required immediate attention.
Addressing the EH Risks of Legalization

1. What environmental health hazards are associated with cannabis cultivation, processing, or use?

2. How will legalization affect the extent, scale, and conditions under which cannabis is cultivated (commercial and personal)?

3. What measures can be implemented to reduce exposures in all phases?
Public Health Hazards Related to Cannabis

- **Cultivation**
  - Biological contaminants (mould and others)
  - Chemical contaminants (pesticides, heavy metals, carbon monoxide)
  - Electrical or fire hazards in poorly designed or illegal set-ups
  - Radiation hazards: UV exposure exceeds occupational health guidelines?

- **Processing**
  - Solvent extraction (explosion risk, burns, deaths, chemical contamination)
  - Testing (quality control) and traceability (recall) of extracted product
  - Additional food safety concerns for edible products

- **Use**
  - Second-hand smoke and maintaining smoke-free public spaces
  - Poisonings related to inexperience or poorly controlled access (children and pets)
  - *Motor vehicle accidents, problematic use, lack of therapeutic options, etc.*
Extent, Scale, and Conditions of Cannabis Cultivation

• Commercial operations:
  – Micro to large scale
  – Subject to good production practices, seed-to-sale tracking, inspection, and testing.
  – Tightest regulation

• Personal cultivation:
  – Up to 4 budding plants
  – **Extremely** difficult to regulate (CACP): Likelihood of overproduction high, but ability to enforce the Act very problematic.¹
  – Limited guidance on how to grow/process/dispose safely
  – Hazardous licit and illicit grow-ops are not going away!

Pests & Biological Contaminants

- Insects
  - Spider mites, aphids, etc.

- Phytopathogens
  - Powdery mildew, mold, blight

- Bacterial contamination
  - Poor production practices → Salmonella, Enterobacter, Enterococcus
  - Current (unregulated) production practices → poorly understood.

- Fungi that attack the dead plant (during drying and curing)
  - Aspergillus, Fusarium, Penicillium, others

- Mycotoxins (aflatoxins) from fungi → a problem?

Photo source: https://potguide.com/pot-guide-marijuana-news/article/the-3-most-common-cannabis-pests-how-to-get-rid-of-them/
Growing conditions can exacerbate pest control and other problems

- Young plants **need high humidity** (70 to 40%)
- Mature plants **produce** moisture – 432 g H₂O per day³
- Growers may try to **seal** the premises for moisture, temperature, or odor control
- Densely **packed** growing conditions
- Slow drying necessary to maintain terpenes (flavour profile), but gives saprophytes a chance to proliferate.

How many plants are too many?

• Most Canadian homes are winterized with relatively low ventilation rates
• Even a few plants can increase moisture burden.
• Johnson and Miller 2012:
  – Typical housing stock varies across Canada.
  – Model based on Ottawa, Windsor & Regina homes
  – Estimated typical ventilation rates, normal moisture burden generated by occupants, moisture due to cultivation of cannabis.
  – Windsor homes (n=59) could tolerate 4-122 plants, Regina similar, Ottawa higher risk (?)

• How does this affect respiratory health?
• What risks will people take to prevent mouldy cannabis?
Developing Pesticide Practices in Colorado

- Costly recalls in Colorado
- CO Depart. of Agriculture now permits limited pesticides
  - Mostly innocuous, but also pyrethrins allowed
  - No guarantee of human safety
- **Not allowed**: Avermectin, Etoxazole, Imidacloprid, Myclobutanil, Spiromesifen
- Seem to be learning

Number of DEH Recalls or Consumer Advisories

<table>
<thead>
<tr>
<th>Year</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
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<tbody>
<tr>
<td>Count</td>
<td>18</td>
<td>12</td>
<td>8</td>
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Pest Management in Cannabis Cultivation (US)

• **Key Issue #1:** Cultivation conditions can make cannabis susceptible to pests, which can wipe out a whole crop ($$$)
  – Strong financial incentive to use more potent options

• **Key Issue #2:** Cannabis is prohibited, therefore no EPA-registered pesticides
  – No guidance on what pesticides may or may not be appropriate

• In the absence of federal guidance, states have various approaches:
  – no regulations ↔ some synthetics ↔ mostly organic ↔ all organic
Pesticides for Cannabis in Canada

- Regulated at the federal level by Health Canada and Pest Management Regulatory Agency (PMRA)
- Currently **20 pesticides** registered for use on medical cannabis
- Mix of oils, salts, detergents, and “biologicals”
- However:
  - Incentive to use more potent “synthetics”
  - Not all appropriate for home use.

*Photo credit: By Herb Pilcher, USDA ARS. Peanut plant protected by insecticidal Bt toxins*
### Is Pesticide Contamination a Problem in Canada (medical cannabis)?

<table>
<thead>
<tr>
<th>Date</th>
<th>Company</th>
<th>Product</th>
<th>Issue</th>
<th>Type</th>
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<tbody>
<tr>
<td>Sept. 2016</td>
<td>Natural Advancement Canna Master Blend</td>
<td>Capsules</td>
<td>CBD, microbial contamination</td>
<td>II</td>
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<tr>
<td>Nov. 2016</td>
<td>Mettrum</td>
<td>Dried cannabis + oil</td>
<td>Myclobutanil, pyrethrins</td>
<td>III</td>
<td>10</td>
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<td>Jan 2017</td>
<td>Organigram</td>
<td>Dried cannabis, oil</td>
<td>Myclobutanil, bifenazate</td>
<td>II + III</td>
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<td>Jan 2017</td>
<td>Aurora Cannabis (Organigram)</td>
<td>Various</td>
<td>Myclobutanil, bifenazate</td>
<td>II</td>
<td>0</td>
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<tr>
<td>March 2017</td>
<td>Aphria</td>
<td>Dried cannabis</td>
<td>Potency lower than advertised</td>
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<tr>
<td>April 2017</td>
<td>Emblem Cannabis</td>
<td>Dried cannabis</td>
<td>Potency lower than advertised</td>
<td>III</td>
<td>0</td>
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<td>May 2017</td>
<td>Peace Naturals</td>
<td>Dried cannabis + oil</td>
<td>Piperonyl butoxide</td>
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<td>1</td>
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<td>May 2017</td>
<td>Hydropothecary</td>
<td>Dried cannabis</td>
<td>Myclobutanil</td>
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<tr>
<td>Aug 2017</td>
<td>Broken Coast Cannabis</td>
<td>Oil</td>
<td>Myclobutanil, spinosad</td>
<td>III</td>
<td>0</td>
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Is Pesticide Contamination a Problem in Canada (medical cannabis)?

- **August 2016**: public can send cannabis to HC-approved labs for testing
  - Three pesticide-related cannabis product recalls
- **Feb. 2017**: HC announces random testing
  - Found 2 out of 7 randomly selected sites also had myclobutanil (fungicide; “Bad Actor”) or piperonyl butoxide (synergist)
- **May 2017**: Mandatory pesticide residue testing added to microbial + chemical testing requirements for medical producers; random checks will continue
- **Jan 2018**: $1 million dollar fine for violations
Is Pesticide Contamination a Problem in Canada (illicit cannabis)?

• Dispensary cannabis **does not (can not)** come from licensed producers, although may be labelled “medical grade.”
  – Sourced primarily from organized crime, very misleading to consumer

• **NCCEH Grow-ops paper**: certain pesticides routinely found on surfaces, and at high levels.

• Investigative journalism:
  – *Globe and Mail*: 1/9 samples had yeast and mold, 2/9 exceeded total aerobic plate count, 3/9 had pathogens, **0/9 pesticides**.
  – *CBC Marketplace*: 10/12 samples did not represent THC content accurately (range, 15-30%).

• Outside Canada:
  – Extensive pesticide presence on plants as well as in cultivation rooms
  – Sullivan et al. 2013 → residues found in smoke
Chemical Contaminants: Metals

• Bioaccumulation of heavy metals naturally present, or due to human emissions, tainted fertilizer.\(^2\)
  – As, Hg, Cd, Pb in seeds, leaves and buds

• Mode of consumption may be important
  – Absorption of some metals via lung >>>> via gut
  – Deep inhalation increases metal exposure from metals in cannabis smoke\(^8\)
Chemical Contaminants: Carbon Monoxide

• CO\textsubscript{2} enrichment (1200-1500 ppm) promotes plant growth and increases yield.

• Can be achieved by:
  – Compressed CO\textsubscript{2} in cylinders
  – Chemical reactions
  – Installing ignition devices,
  – Venting furnace into home

• Ignition devices are widely available, but are they a problem? Unclear....
Physical Hazards: Fires and Shocks

• Electrical hazards related to improperly installed equipment and/or tampering with supply
  – BC in 2010: $100 million stolen from grid
  – Smart meters + “Raptor” sensors (80% reduction in theft in 2016)\(^9\)
  – City of Surrey → homes using >95 kW per day singled out for fire inspection.

• Fire hazards related to:
  – Hot lamps, electrical draw, overloads/shocks
  – During an actual fire (compressed gas, fertilizers, pesticides, obstacles).
Radiation Hazard: Ultraviolet Light

• Grow lamps, generally.
• Also, UVA/B used to increase THC content; UVC used for pathogen control
• University of Washington School of Public Health (poster at AIHA 2017)\(^{10}\)
  – Higher intensity in nurseries vs. in vegetative growth rooms
  – Working for **8 hours** in the nursery would cause a worker to exceed the threshold limit value (TLV) for UV by about **9 fold**!
• Lieberman et al. 2017 \(\rightarrow\) what personal protective equipment should workers be using?\(^{11}\)
• At home: tampering with UV lamps.
Radiation Hazard: Ultraviolet Light

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Solvent Extraction

• Flammable solvents used to extract cannabinoids, then purged by heating.

• Risk of fires or explosions
  – Property damage, burns, death
  – Poisoning from residual solvent
  – Concentrating contaminants

• US legalization: decriminalization and legalization associated with increase in explosions and injuries
  – Colorado – 29 serious burns (2008-2014)

Photo source: http://s.newsweek.com/sites/www.newsweek.com/files/2015/01/19/hashoilexplosion.jpg
Solvent Extraction

• Also happening in Canada:
  – 36 incidents since 1996 in BC
  – 30 incidents in ON in last 5 years

• **WHY** do people do this?
  – Different high, different experience
  – Can be made from waste product.

• Will legalization exacerbate the problem in Canada?

• May be dependent on:
  – Access to raw material (personal cultivation limits)
  – Access to legal concentrates
  – Penalties?
Testing and Quality Assurance

- Based on ACMPR → applies to nurseries, cultivators, and processors
- Every lot or batch of product must be tested for:
  - microbial and chemical contaminants,
  - solvent residues (if used),
  - THC, CBD, CBDA
  - Unauthorized pesticides
- Facility must employ a quality assurance person
- Need to have a recall system in place; processors maintain sample for 1 year
- Labs need analytical testing license
Testing Challenges for Canada

• Are the medical testing requirements sufficient/appropriate for non-medical system and products?
  – E.g., illegally used pesticide may be ‘undetectable’ on dried flower, but may be hazardous in concentrates.¹³

• Will sufficient lab capacity be in place to handle new demand?

• Will the enormous scale of some commercial grow operations encourage the (illegal) use of synthetics?
  – How do you know what pesticides to test for?
Food Safety

• Food preparation and handling

• Packaging and labelling
  – Limit: 10 mg/serving;
  – childproof packaging;
  – obvious labelling;
  – no animal, fruit or cartoon shapes.

• Traceability: tracking seed to sale.


Food Safety and Cannabis Regulation Webinar (Public Health Ontario)

Marijuana edibles: Food Safety and Regulatory Aspects
Dr. Keith Warriner, University of Guelph

https://pho.adobeconnect.com/_a1158264515/p8dcy7b5usw/

Also listed on the NCCEH Cannabis Resources page.
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SHS and Vaping in Public and Private Spaces

• Where can you use cannabis?
  – Anti-smoking laws apply
  – Public parks vs. restricted access clubs/cafes vs. private property
  – Also... mobile venues!

• Private residences and multi-residential buildings
  – Concerns regarding second (and third) hand smoke and odours, especially in condos.
Poisonings/Overdoses

- Populations of concern: children, naïve users, pets
- Data sources: ED visits, hospitalizations, calls to poison control centers.
- US National Poison Data System: increase in child poisonings increasing year over year related to edibles\(^1\)\(^4\)
- BC: DPIC project, increasing over time; edibles implicated.

What can we do to reduce EH risks?

- Evidence-based policy → Legalization is necessary to facilitate research
- Knowledge translation and public education
- Health surveillance
- Developing the tools for PHIs/EHOs
- Gear up for edibles and concentrates (2019?)
What is NCCEH doing about all this?

• Topic Page: Resources for EH Practitioners
• Webinar on risk messaging
• *Growing at Home: Health and Safety Concerns for Personal Cultivation*
• February (or March?) E-News: Focus on Cannabis
• Other cannabis team members:
  – Anne-Marie Nicol; Leela Steiner
What can you do RIGHT NOW???

• Converse with us!
  – *Growing at Home: Health and Safety Concerns for Personal Cannabis Cultivation*
  – Looking for input on policy/regulatory options

• Health Canada consultation
  – Online questionnaire and/or written submission
  – January 20th, 2018
THANK YOU!
For more information, please visit the NCCEH Cannabis Topic Page, or reach out!

www.ncceh.ca  ||  www.ccnse.ca

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References


References


