National Collaborating Centre for Environmental Health

Centre de collaboration nationale en santé environnementale

www.ncceh.ca

Cannabis Legalization and Environmental Health

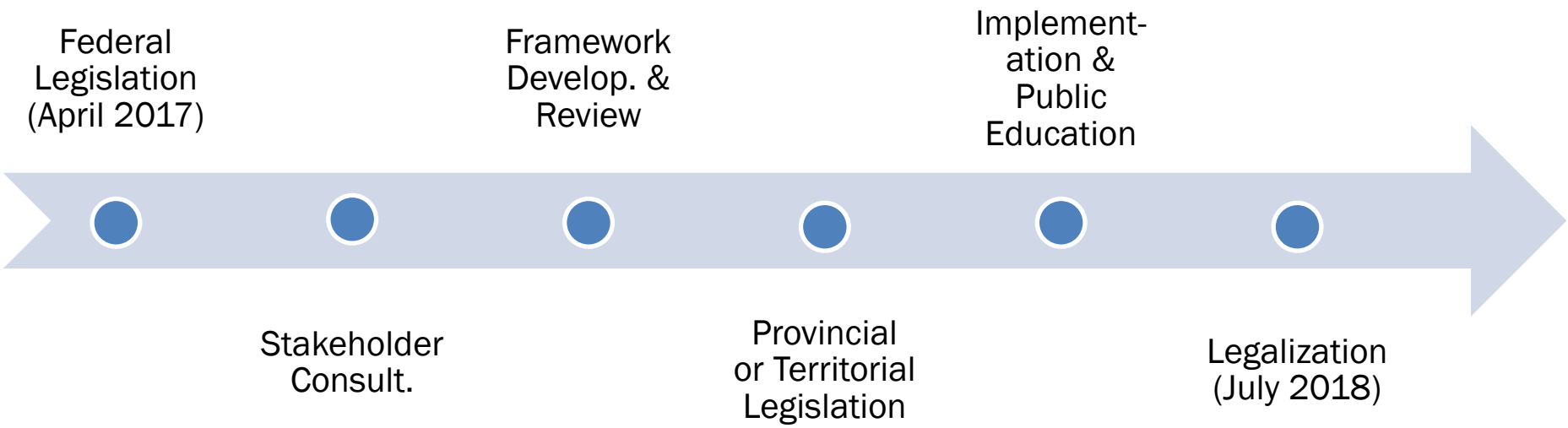
Angela Eykelbosh, PhD

Environmental Health and Knowledge Translation Scientist

NCCEH Environmental Health Seminar Series

January 10th, 2018

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!**

Photo source: http://www.ontarioremediation.ca/wp-content/uploads/2013/07/police-in-grow-house.jpg

Pests & Biological Contaminants

- Insects
  - Spider mites, aphids, etc.
- Phytopathogens[2]
  - Powdery mildew, mold, blight
- Bacterial contamination[2]
  - Poor production practices → *Salmonella, Enterobacter, Enterococcus*
  - Current (unregulated) production practices → *poorly understood.*
- Fungi[2] 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 H_2O per day[3]
- 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.

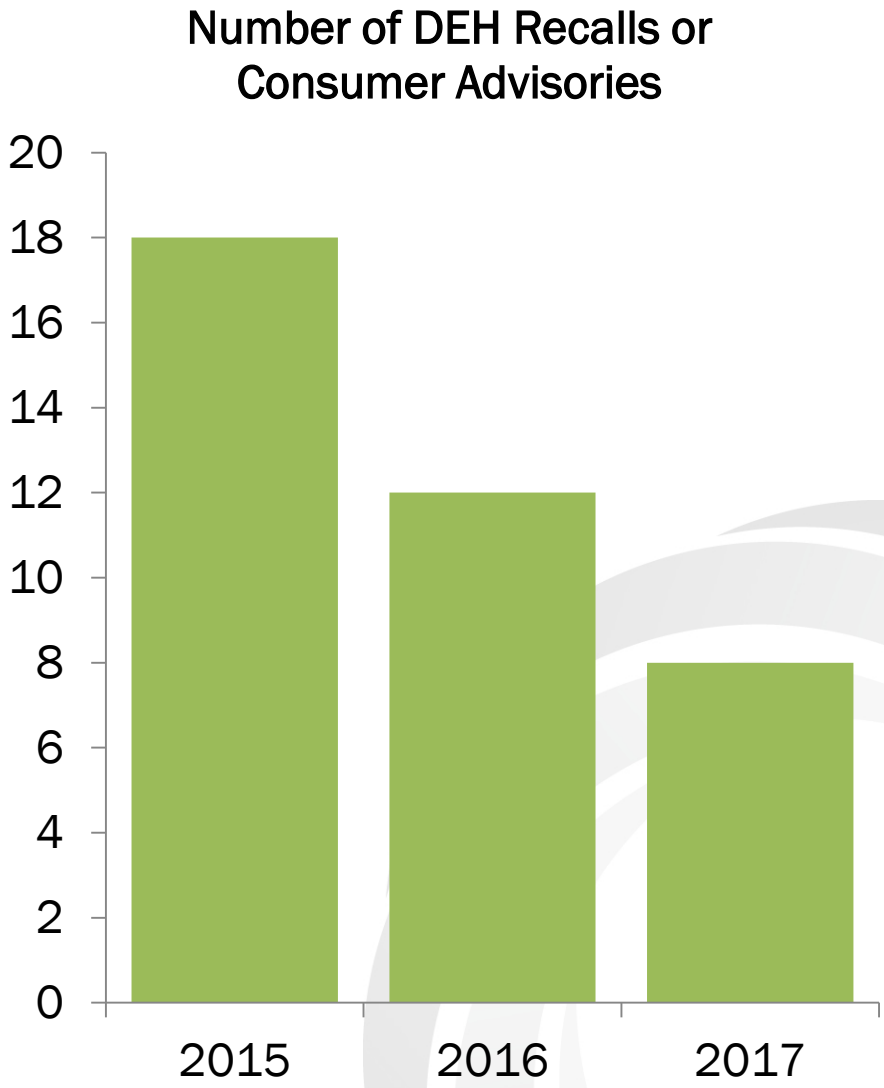
Photo source: http://www.ontarioremediation.ca/wp-content/uploads/2013/07/police-in-grow-house.jpg

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



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[4]

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)?

Date	Company	Product	Issue	Type	Adverse Rxn
Sept. 2016	Natural Advancement Canna Master Blend	Capsules	CBD, microbial contamination	II	0
Nov. 2016	Mettrum	Dried cannabis + oil	Myclobutanil, pyrethrins	III	10
Jan 2017	Organigram	Dried cannabis, oil	Myclobutanil, bifenazate	II + III	1
Jan 2017	Aurora Cannabis (Organigram)	Various	Myclobutanil, bifenazate	II	0
March 2017	Aphria	Dried cannabis	Potency lower than advertised	III	0
April 2017	Emblem Cannabis	Dried cannabis	Potency lower than advertised	III	0
May 2017	Peace Naturals	Dried cannabis +oil	Piperonyl butoxide	III	1
May 2017	Hydropothecary	Dried cannabis	Myclobutanil	III	0
Aug 2017	Broken Coast Cannabis	Oil	Myclobutanil, spinosad	III	0

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[5,6]
  - Sullivan et al. 2013 → residues found in smoke[7]

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_2 enrichment (1200-1500 ppm) promotes plant growth and increases yield.
- Can be achieved by:
  - Compressed CO_2 in cylinders
  - Chemical reactions
  - Installing ignition devices,
  - Venting furnace *into* home

} CO

- 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 → what personal protective equipment should workers be using?[11]
- At home: tampering with UV lamps.

Radiation Hazard: Ultraviolet Light

Photo source: https://ca.news.yahoo.com/blogs/dailybrew/ottawas-new-medical-pot-rules-face-legal-171213387.html

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, death, 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.*

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

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

- US legalization: decriminalization and legalization associated with increase in explosions and injuries
  - Colorado – 29 serious burns (2008-2014)
  - California – 101 serious burns (2007-2014)

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.**

By Vjiced (Own work) [CC BY-SA 3.0 (http://creativecommons.org/licenses/by-sa/3.0)], via Wikimedia Commons

- 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.

Photo source: https://i0.wp.com/smartcolorado.org/wp-content/uploads/2014/08/edibles-8.jpg?fit=1024%2C765

Photo source: http://www.bostonmagazine.com/news/2013/08/22/nugtella-medical-marijuana-massachusetts/

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.

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, death, chemical contamination)
- Testing (quality control) and traceability (recall) of extracted product
- Packaging and labelling
- 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.*

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[14]
- BC: DPIC project, increasing over time; edibles implicated.

http://www.cbc.ca/news/canada/british-columbia/victoria-parents-urged-to-check-halloween-candy-after-marijuana-gummies-found-in-trick-or-treat-haul-1.4383616

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*

Angela.Eykelbosh@bccdc.ca

Anne-Marie.Nicol@bccdc.ca

Leela.Steiner@bccdc.ca

BC Centre for Disease Control
An agency of the Provincial Health Services Authority

*Production of this document has been made possible through a financial contribution from the **Public Health Agency of Canada** .*

National Collaborating Centre for Environmental Health

Centre de collaboration nationale en santé environnementale

References

1. Serr M, Carrique T, Malashenko L. C-45 - An Act respecting cannabis and to amend the Controlled Drugs and Substances Act, the Criminal Code and other Acts - Short Title - Cannabis Act. 2017. Available at: https://www.cacp.ca/index.html?asst_id=1509. (Accessed: October 31, 2017).
2. McPartland JM, McKernan KJ. Contaminants of Concern in Cannabis: Microbes, Heavy Metals and Pesticides. In: Chandra S, Lata H, ElSohly MA, editors. *Cannabis sativa L - Botany and Biotechnology. Cham: Springer International Publishing; 2017. p. 457-74.*
3. Johnson LI, Miller JD. Consequences of Large-scale Production of Marijuana in Residential Buildings. *Indoor and Built Environment. 2011;21(4):595-600. Available at: http://dx.doi.org/10.1177/1420326X11411954. (Accessed: 2017/07/10).*
4. Feldman J. Pesticide use in Marijuana Production: Safety Issues and Sustainable Options. *Pesticides and You. 2014-2015.*
5. Cuypers E, Vanhove W, Gotink J, Bonneure A, Van Damme P, Tytgat J. The use of pesticides in Belgian illicit indoor cannabis plantations. *Forensic Science International. 2017;277:59-65. Available at: http://www.sciencedirect.com/science/article/pii/S0379073817301871.*
6. Schneider S, Bebing R, Dauberschmidt C. Detection of pesticides in seized illegal cannabis plants. *Analytical Methods. 2014;6:515-20. Available at: http://pubs.rsc.org.ezproxy.library.ubc.ca/en/Content/ArticleLanding/2014/AY/C3AY40930A#!divAbstract.*
7. Sullivan N, Elzinga S, Raber JC. Determination of Pesticide Residues in Cannabis Smoke. *Journal of Toxicology. 2013;2013:6. Available at: http://dx.doi.org/10.1155/2013/378168.*
8. Moir D, Rickert WS, Levasseur G, Larose Y, Maertens R, White P, et al. A comparison of mainstream and sidestream marijuana and tobacco cigarette smoke produced under two machine smoking conditions. *Chemical research in toxicology. 2008;21(2):494-502.*

References

9. Eagland N. New B.C. Hydro devices save millions of dollars from cannabis-growing power thieves. *Vancouver Sun. 2016.*
10. Chmielinksi M, Simpson C, Cohen M, Isaken T, Yost M, Ehrlich T. Measuring Worker Exposures to Ultraviolet Radiation in the Cannabis Industry. American Industrial Hygiene Conference & Exposition 2017; Seattle, WA2017.
11. Lieberman J, Brown R, Phalen RN. Growing Pains: Personal Protective Equipment for Workers in the Emerging Cannabis Industry. *The Synergist. 2017 May.*
12. Romanowski KS, Barsun A, Kwan P, Teo EH, Palmieri TL, Sen S, et al. Butane Hash Oil Burns: A 7-Year Perspective on a Growing Problem. *Journal of burn care & research : official publication of the American Burn Association. 2017;38(1):e165-e71.*
13. Raber JC, Elzinga S, Kaplan C. Understanding dabs: contamination concerns of cannabis concentrates and cannabinoid transfer during the act of dabbing. *Journal of Toxicological Sciences. 2015;40(6):797-803. Available at: https://www.ncbi.nlm.nih.gov/pubmed/26558460.*
14. Cao D, Srisuma S, Bronstein AC, Hoyte CO. Characterization of edible marijuana product exposures reported to United States poison centers. *Clinical Toxicology (15563650). 2016;54(9):840-6. Available at: http://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=118584202&site=ehost-live&scope=site.*