2nd and 3rd Hand Marijuana Smoke and Vapor: It’s All Around Us!

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University of California Office of the President and Co-Chair African American Tobacco Control Leadership Council (AATCLC)

Health Effects of Secondhand Smoke from Marijuana

The 2019 North American Cannabis Summit
Los Angeles, California
January 28, 2019
The Evolving “Smoking” Landscape

- Hookah pens aerosolizing flavored liquids, with and without nicotine
- Heat-not-burn products that produce an aerosol, but no fire or smoke
- Colorfully packaged, flavored little cigars and cigarillos, both regular and electronic
- Butane derived THC that you can dab
- Liquid THC, which you can aerosolize.

- All of these products will have a unique 2nd and 3rd hand smoke/vapor Chemical footprint
Co-Mingling; Dual and Poly Use:

- **Blunts**
  - Hollowed out Cigars filled with marijuana

- **Caviar**
  - Adding Crack cocaine or crystal meth to Blunts

- **Roll Your Own**
  - Spliffs

- **Mix Your Own**
  - Cocktails (assorted e-liquids, flavors and nicotine)
  - Compounding 2nd and 3rd hand smoke and vapor
Blunts: Hollowed-out Cigars Filled with Marijuana
Nearly 4000 High School Students in Connecticut completed an anonymous survey

- 27% who have used both marijuana and e-cigarettes reported using e-cigarette aerosolizers to vaporize cannabis including hash oil, and wax THC. (Morean et al., 2015)
Dried plant smoke:
similar chemicals in varied proportions

Sample comparisons of components of tobacco and marijuana secondhand smoke

<table>
<thead>
<tr>
<th>Component</th>
<th>Tobacco (mg/cig)</th>
<th>Marijuana (mg/cig)</th>
</tr>
</thead>
<tbody>
<tr>
<td>tar</td>
<td>24.3 ± 1.8</td>
<td>49.7 ± 2.5*</td>
</tr>
<tr>
<td>NO</td>
<td>1101 ± 47</td>
<td>2087 ± 152*</td>
</tr>
<tr>
<td>CO</td>
<td>61.7 ± 2.0</td>
<td>54.0 ± 3.7*</td>
</tr>
<tr>
<td>nicotine</td>
<td>4.77 ± 0.26</td>
<td>0.065 ± 0.018*</td>
</tr>
<tr>
<td>ammonia</td>
<td>5568 ± 322</td>
<td>14270 ± 472*</td>
</tr>
<tr>
<td>HCN (µg/cig)</td>
<td>83.8 ± 7.9</td>
<td>685 ± 29*</td>
</tr>
<tr>
<td>pyridine</td>
<td>265 ± 11</td>
<td>307 ± 14*</td>
</tr>
<tr>
<td>benzene</td>
<td>290 ± 11</td>
<td>341 ± 12*</td>
</tr>
<tr>
<td>toluene</td>
<td>516 ± 20</td>
<td>704 ± 29*</td>
</tr>
<tr>
<td>styrene</td>
<td>105 ± 10</td>
<td>162 ± 10*</td>
</tr>
<tr>
<td>naphthalene (ng/cig)</td>
<td>6861 ± 419</td>
<td>16748 ± 2396*</td>
</tr>
<tr>
<td>formaldehyde (µg/cig)</td>
<td>888 ± 47</td>
<td>383 ± 27*</td>
</tr>
<tr>
<td>acetaldehyde (µg/cig)</td>
<td>1587 ± 45</td>
<td>1170 ± 69*</td>
</tr>
<tr>
<td>acrolein (µg/cig)</td>
<td>437 ± 10</td>
<td>304 ± 20*</td>
</tr>
<tr>
<td>methyl ethyl ketone (µg/cig)</td>
<td>222 ± 9</td>
<td>160 ± 11*</td>
</tr>
<tr>
<td>phenol (µg/cig)</td>
<td>264 ± 13</td>
<td>260 ± 11</td>
</tr>
<tr>
<td>m + p-cresols (µg/cig)</td>
<td>64.6 ± 2.5</td>
<td>104 ± 6*</td>
</tr>
<tr>
<td>pyrene (ng/cig)</td>
<td>528 ± 35</td>
<td>609 ± 60*</td>
</tr>
<tr>
<td>benzene)pyrene (ng/cig)</td>
<td>94.9 ± 6.9</td>
<td>87.9 ± 7.5*</td>
</tr>
<tr>
<td>anthracene (ng/cig)</td>
<td>755 ± 38</td>
<td>1135 ± 75*</td>
</tr>
</tbody>
</table>

From Moir et al., 2008. Subset of 65 components analyzed under standard tobacco smoking conditions.

It is not known to what extent the differences in the growth conditions between the marijuana and the tobacco, including the type of fertilizer used, influenced the levels of nitrite in the plants. The temperature of combustion may also influence the production of ammonia. Burning tobacco results in a reduction of nitrate to ammonia, which is released in a greater extent during mainstream smoke formation (7), suggesting that lower combustion temperatures favor the production of ammonia. The differences between marijuana and tobacco may be related to the differences in the growth conditions.

Inhaling a whole chemistry lab...
Pod Switching

- Pod switching; People using multiple substances (Can you say Triangulum); [https://www.youtube.com/watch?v=S7oSm5zuTc](https://www.youtube.com/watch?v=S7oSm5zuTc)

- The JUUL Explosion will have its corresponding 2nd and 3rd hand aerosol explosion; even if you aren’t a young adult using JUUL, you still probably have been exposed
Dabbing
Dabbing

- Dabbing: Inhaling the vapors from a concentrated form of marijuana made by an extracting THC using butane gas.

- Dabs, also known as butane hash oil (BHO) — "bladder," "honeycomb" or "earwax"

- Dabbing will leave its own unique chemical footprint
3 in 1: Herb, Liquid or Wax
Our Presenters

- Matthew Springer, Professor of Medicine, University of California, San Francisco
Our Presenters

- Suzaynn Schick, Ph.D., Associate Professor of Medicine, University of California, San Francisco
Our Presenters

- Cynthia Hallett, M.P.H., President and CEO, Americans for Nonsmokers Rights
Our Moderator

- Phillip Gardiner, Dr.P.H., Senior Program Officer, Tobacco-Related Disease Research Program
Secondhand smoke from marijuana: The return of a familiar problem

Matthew L. Springer, Ph.D.
Professor of Medicine, UCSF
1/28/19
Xiaoyin Wang
Jiangtao Liu
Ronak Derakhshandeh
Leila Mohammadi
Daniel Han
Poonam Rao
Jess Rodriguez
Ming Chen
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Pooneh Nabavizadeh
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Robert Su
Eric Nordsieck
Qiumei Chen
Rikki Sharma
Amanda Selchau
Stanley Ye
Stephenie Le
Emmy Luu
Olivia Danforth
Gus Guttierez
Kirstin Aschbacher

Flight Attendant Medical Research Institute, NIH/NIDA, FDA Center for Tobacco Products, NIH/NHLBI, Elfenworks Foundation, CA Tobacco-Related Disease Research Program
airplane
The Bad Ol' Days

bar
1/2 mile from UCSF!

4/20/2017

4/20/2018
SF, 2017... REALLY!!!
(the return of a familiar problem)

“NOW SERVING CANNABIS FOR BRUNCH
In S.F., gourmet fare infused with artisanal weed
offers medicated spreads to new connoisseurs”
– SF Chronicle 1/22/17
Secondhand smoke (SHS)

- Smoking causes over 140,000 cardiovascular deaths in the US per year
- Secondhand smoke is estimated to cause ~50,000 US deaths/year, mostly from cardiovascular disease
- Smoking bans in public places lead to reduction in frequency of heart attacks
Tobacco secondhand smoke exposure impairs ability of arteries to **vasodilate** when they need to pass more blood

(Vasodilation: Arteries grow in diameter when necessary)

Important: Impairment is temporary, but repeated exposures lead to **long-term** impairment

“Flow-mediated dilation” (**FMD**)
1 minute of secondhand smoke exposure was enough to impair vascular endothelial function in rats

n=8 for all groups
*P<.01 impairment vs. mean of pre-exposure and recovery

Pinnamaneni et al., 2014, Nicotine Tob. Res. 16:584-590
Problem: General public avoids tobacco SHS but many think marijuana SHS is ok

"There's no nicotine"

"It's natural"

"No one said it ISN'T ok"

"It's medicinal"
2. Business Activity/Schedules

Your business activity is: RESEARCHER (I)

Please make any requested changes to your registered schedules below, and select Next to continue.

DRUG SCHEDULES

Select all that apply

- Schedule

Is the researcher human? □ Both □ Human Only □ Non-Human Only

☐ Check here if you require order forms to only purchase Schedule I and II from suppliers.

*Fields with a (*) are required.*

<-Previous  Next->

- Cancel -
Impairment from one minute of marijuana SHS persists longer than impairment from tobacco SHS.

- ~670 µg/m³ particles (PM2.5)
Marijuana SHS for 1 minute lowered FMD for at least 90 minutes; cannabinoid-independent

1 minute exposure (THC-free)

Wang et al., 2016, J Am Heart Assoc 5:e003858
“They totally smoke out the rats”

The smoke was invisible in the exposure chamber.
Acute and long-term cardiovascular risk is unclear

Risk of MI goes up ~5-fold in the hour after marijuana use (Mittleman, 2001)

Mortality from MI may or may not increase in marijuana users (Mukarnal, 2008; Frost, 2013)

No clear correlation between long-term marijuana use and cardiovascular disease later in life (e.g., Reis, 2017 CARDIA study)

...but, increased MI, heart failure, stroke reported for marijuana users relative to non-users (e.g., Kalla et al., Charni et al., 2017 ACC conference)
Is FMD impaired by Volcano vaporizer cannabis aerosol?

Jiangtao Liu, Pooneh Nabavizadeh,
Impairment of endothelial function by one IQOS HeatStick ("heat-not-burn" tobacco product)

Pooneh Nabavizadeh

IQOS
p=.0001

Mainstream exposure (5 s smoke + 25 s break) x 10

Nabavizadeh et al., Tob Cont. 2018
Serum from e-cigarette users inhibits nitric oxide production from cultured endothelial cells

with Suzaynn Schick and Peter Ganz

(...and Carnevale et al. showed that e-cig use impairs FMD in humans)
FMD can be impaired by Volcano vaporizer aerosol
(preliminary results)

- Air from vaporizer (empty chamber; 1 min)
- Mainstream vaporizer aerosol (5s every 60s for 5 min)
- Secondhand vaporizer aerosol (4.3 cc vapor into chamber; 1 min)
Inhalation of inert particles impairs FMD
(Simple does-it-or-doesn’t-it experiment)

- <100 nm inert carbon particles for 10 min
- Comparable particle number to 600 µg/m³ SHS

Graphs showing FMD (%) before and after exposure to air, SHS, and particles, with p-values for each condition.
Summary (1)

Marijuana SHS for one minute substantially impairs vascular endothelial function in rats.

Neither THC nor paper smoke are required for marijuana SHS to impair vascular function.

...nicotine is not required for impairment of vascular function by smoke.

One minute of marijuana SHS exposure impairs vascular function for at least 90 minutes, longer than impairment from tobacco SHS.
Summary (2)

Mainstream use of IQOS heat-not-burn tobacco product impairs FMD like smoking a cigarette.

E-cigarette use (in humans) causes changes in blood that impair endothelial NO production.

Mainstream and modeled secondhand exposure to Volcano aerosol can impair FMD (preliminary).

Inhalation of inert particles impairs FMD.
Bottom Line:

Breathe clean air

Public exposure to secondhand smoke should be avoided whether the source is tobacco or marijuana.
Particulate Air Pollution at Two Cannabis Dispensaries in Northern California

Suzaynn F. Schick, Department of Medicine, Division of Occupational and Environmental Medicine, University of California, San Francisco
Acknowledgements

- Funded by California Tobacco-Related Disease Research Program grant # 28IR-0049
- No conflicts to declare
- Thank you to:
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  - Amanda Rieman, PhD
  - Kazukio Kumagai, PhD
  - Julia Buss, PhD
  - Jennifer Ho, BA
  - Linda Nguyen
  - Morgan Lee
  - The People at Dispensary 1
The Challenges of Measuring Environmental Cannabis

- Diverse products
  - Flowers
  - Extracts
  - Vape pens
  - Edibles & Topicals

- Diverse methods of use
  - Combustion
  - Dabbing
  - Vaporizing* flowers
  - Vaping* extracts

- Diverse populations

- Difficulty accessing research cannabis for controlled experiments
Dispensaries with Onsite Use Permits

“a local jurisdiction may allow for the smoking, vaporizing, and ingesting of cannabis or cannabis products on the premises of a retailer or microbusiness”

- Restricted to 21 and over
- Not visible from public or non-age restricted areas
- Sales of alcohol and tobacco not permitted

- For consumption of purchases only
2 Dispensaries: A Natural Experiment

- Dispensary 1
  - Vaporizing, dabbing and vaping
  - Only devices provided by dispensary are permitted
  - Minimum price: $3.00 single serving cannabis concentrate

- Dispensary 2
  - Smoking, dabbing and vaping
  - Provides dab rigs, bongs and lighters, customer devices permitted
  - Minimum price: $10.00 prerolled cannabis cigarette
2 Dispensaries: Structure and ventilation

- **Dispensary 1**
  - Ground floor, 2 stories, reinforced concrete, built in 1970’s
  - Estimated room area = 14,000 ft³ (400 m³)
  - Central HVAC w/4 inlets + 4 window AC units

- **Dispensary 2**
  - Ground floor, 3 stories, reinforced concrete, built in 1920’s
  - Estimated room area = 16,000 ft³ (450 m³)
  - One HVAC inlet (?), one small air circulating fan
Experimental methods

- Measure fine particle concentration in air
  - Laser photometers (SidePaks and Dusttrak)
  - Air pumps and filters (preweigh filter, collect air sample, post weigh)
  - We use cyclones and impactors to block particles over 2.5 µm

- Measure room
- Count staff and customers
- Log cannabis use behavior
- Log demographic data (No IRB, no direct interactions)
Dispensary 1: Open surveillance

- 2 researchers
- Check in with security and management
- Put instruments on tables next to vaporizers and dab rigs
  - 2-3 tables with 1 Volcano vaporizer and 1 electric dab rig
- Count staff and customers
- Log cannabis use behavior and demographic data
- Sample for 1 - 4 hours
Dispensary 2: Covert surveillance

- 2 - 4 researchers + 2 - 4 volunteer cannabis users
- Carry instruments in backpacks
- Purchase cannabis article
- Enter lounge: researcher turns on instruments, volunteer uses cannabis
- Count staff and customers
- Log cannabis use behavior and demographic data
- Sample for 30 minutes, exit, repeat if staffing permits
Race and Ethnicity (estimated)

<table>
<thead>
<tr>
<th></th>
<th>Asian</th>
<th>Hispanic</th>
<th>African American</th>
<th>Caucasian</th>
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<tr>
<td>Dispensary 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>52</td>
<td>10</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>Dispensary 2</td>
<td>20</td>
<td>10</td>
<td>20</td>
<td>50</td>
</tr>
</tbody>
</table>
Gender

Dispensary 1

Dispensary 2

1:1 ratio

2:3 ratio

Female
Male

# of people
## Modes of use

<table>
<thead>
<tr>
<th>Method</th>
<th>Dispensary 1</th>
<th>Dispensary 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaporizer</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>Joint</td>
<td></td>
<td>377</td>
</tr>
<tr>
<td>Water Pipe</td>
<td></td>
<td>84</td>
</tr>
<tr>
<td>Vape Pen</td>
<td></td>
<td>32</td>
</tr>
<tr>
<td>Dab</td>
<td>22</td>
<td>29</td>
</tr>
<tr>
<td>Blunt</td>
<td></td>
<td>17</td>
</tr>
<tr>
<td>Pipe</td>
<td></td>
<td>17</td>
</tr>
</tbody>
</table>
Airborne fine particles (PM$_{2.5}$) µg/m$^3$

Average = 153 µg/m$^3$

Average = 1,189 µg/m$^3$
Comparing Dispensary 1 to Dispensary 2

- Particle concentration: 2 was 4-12 times higher than 1
- Sources: 2 had 16-80 times more sources than 1
- Air exchange rate: 1 had a higher air exchange rate than 2
- Particle deposition rates: unknown
Next steps

- Improve methods for counting sources

- Measure total PM2.5 emissions and characterize chemical composition of emissions from:
  - Vaporizers
  - Electronic dab rigs
  - Vape pens

- Keep measuring cannabis-associated air pollution in public places
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Trend Toward Preserving Smokefree Environments in an Age of Legalized Marijuana

Cynthia Hallett, MPH
President and CEO
Established in 1984, our services include:

- Providing resources, tools, and strategic planning
- Tracking industry or allied opposition tactics
- Assisting with message development
- Illustrate policy trends via ordinance lists & maps
- Provide personalized training, technical assistance, and support
- Provide data to researchers evaluating the impact of tobacco control laws and college policies on public health
States with Legalized Marijuana
American Nonsmokers’ Rights Foundation
January 2, 2019

State Law
- Recreational and Medical Marijuana Use is Legal
- Marijuana use is not Legal
- Medical Marijuana Use, but not Recreational, is Legal

Note: American Indian and Alaska Native sovereign tribal laws are not reflected on this map.
Focus on Health Effects of Secondhand Marijuana Smoke on Nonsmokers

Smoke is Still Smoke

www.nosmoke.org
Tobacco use amongst adults and youth is on the decline; however, use of electronic smoking devices, including JUUL, and that co-use of combustible marijuana and tobacco is on the rise. One strategy to reduce use is to include e-cigarettes and marijuana in smokefree laws.
Compare and Contrast...
Normalizing Marijuana Use and Users

Different Types of Smoking Devices:
- Tobacco:
  - Cigarette & Cigar
  - Vaporizer
- Weed:
  - Joint
  - Bong
  - Pipe
  - Vaporizer

Deaths:
- Tobacco: 443,000
- Weed: 0

Health Issues:
- Tobacco:
  - Lung Cancer
  - Chronic Obstructive Pulmonary Disease
- Weed:
  - No recorded cancer cases linked to MJ, in fact it is seen as a cure.

Dependence and Withdrawal Symptoms:
- Tobacco:
  - Anxiety
  - Depression
  - Impaired performance
  - Irritability, frustration, and anger
  - Sleep disturbances, such as insomnia or sleeping too much
- Weed:
  - Feelings of unreality
  - Pleasure
  - Sense of well-being
  - Slowed speech
  - Increase in appetite

www.no-smoke.org
Will the Marijuana Industry become the New Tobacco Industry or Vice Versa?

Potential Big Tobacco Acquisition Causes Cannabis Company’s Stock to Soar

Sara Brittany Somerset
Contributor

Green is the New Black
Sustainable growing practices that can boost your bottom line

California's legal cannabis sales fell 10% in the first quarter, but the industry remains strong. Here's why.

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California's legal cannabis sales fell 10% in the first quarter, but the industry remains strong. Here's why.

Smart Approaches to Marijuana (SAM)’s legalization opponent Kevin Sabet may be right: like it or not Big Tobacco is invading cannabis.

Altria, the company that invited unwitting consumers for decades to come to where the cancer is –Marlboro Country— may be looking to shore up stagnant cigarette sales by purchasing Canadian cannabis company Cronos Group.

Beginners Could Become “Pot Stock Millionaires”, U.S. Citizens Could Make Fortunes

OPEN
3 Reasons Big Tobacco and Marijuana Partnerships Are Imminent

With tobacco usage declining, partnering with the pot industry is a logical evolution.

Sean Williams (TMFUltraLong)
Sep 8, 2016 at 11:41AM

The green rush is in full force. Beginning in less than six weeks, recreational marijuana will be completely legal in Canada. Aside from Canada becoming the first developed country in the world, and second overall, to wave the proverbial green flag on adult-use weed, this move could also generate upwards of $5 billion in added annual revenue once the industry is running on all cylinders.

Dealmaking ramps up as legalization inches closer
Legalizing weed in our neighbor to the north has also spurred a lot of dealmaking activity both outside and within the cannabis industry. Within the industry, leading producer Aurora Cannabis, which is expected to yield 570,000 kilograms a year once fully operational, acquired Cannimed Therapeutics and Ontario-based MedReleaf for $852 million and approximately $2.5 billion, respectively.
A Thought Experiment: What if Social Toking Replaced Drinking?

BY ADRIANNE WILSON-POE, PHD ON APRIL 16TH, 2018 AT 10:54 AM | UPDATED: APRIL 16TH, 2018 AT 11:30 AM

What would our society look like if cannabis replaced alcohol as the socially acceptable means of celebrating, unwinding, and getting loose on the weekends? Let's have a look at the evidence for this thought experiment.
A Public Health Framework for Legalized Retail Marijuana Based on the US Experience: Avoiding a New Tobacco Industry

Rachel Ann Barry¹, Stanton Glantz¹,²*

¹ Center for Tobacco Control Research and Education and Philip R. Lee Institute for Health Policy Studies, University of California, San Francisco, San Francisco, California, United States of America, ² Department of Medicine, University of California, San Francisco, San Francisco, California, United States of America

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Summary Points

• The US states that have legalized retail marijuana are using US alcohol policies as a model for regulating retail marijuana, which prioritizes business interests over public health.

• The history of major multinational corporations using aggressive marketing strategies to increase and sustain tobacco and alcohol use illustrates the risks of corporate domination of a legalized marijuana market.

• To protect public health, marijuana should be treated like tobacco, not as the US treats alcohol: legal but subject to a robust demand reduction program modeled on successful evidence-based tobacco control programs.

• Because marijuana is illegal in most places jurisdictions worldwide (including other US
Recreational Marijuana Legalized

www.no-smoke.org
Conclusions and Recommendations

- Marijuana, legal or not, creates secondhand smoke.
- **There is science** about the particulate matter created by secondhand marijuana smoke, and more is coming.
- **There is science** about the health effects of secondhand marijuana smoke, and more is coming.
- Research demonstrates that ventilation systems cannot remove all of the hazardous gases, toxins, and particulate matter created by secondhand smoke and aerosol; therefore, *ventilation is not a solution*. Smokefree environments protect workers and patrons from exposure to secondhand smoke and aerosol.

www.no-smoke.org
To protect nonsmokers from the health consequences of exposure to secondhand tobacco and marijuana smoke, as well as the secondhand aerosol from electronic and “vapor” products, tobacco, marijuana, and electronic smoking devices should not be permitted for use in smokefree spaces.

Instead of making concessions for indoor smoking spaces, one should consider identifying outdoor spaces, obstructed from public view, and where the risk of secondhand exposure is minimized.
Secondhand Marijuana Exposure is Increasing

As more states legalize marijuana for recreational or medical use, there can be significant implications for current and future smokefree protections.

MARIJUANA.

Marijuana, just like other forms of smoking or vaping, is not “safe” compared to breathing clean air.

Secondhand marijuana smoke contains hazardous fine particulates and hundreds of chemicals, similar to secondhand tobacco smoke. For workers and the public, it can become another cause of indoor air pollution. Nobody should have to breathe drifting secondhand smoke of any kind in the job, in an apartment building, or in other shared air spaces.

Supporting decriminalization of marijuana does not mean that non-users should have to breathe the secondhand emissions.

States with Legalized Marijuana

This map shows which U.S. states have legalized marijuana. VIEW PDF

State and Local Laws Prohibiting Smoking AND Vaping Marijuana

This map shows which U.S. states and municipalities have laws that prohibit smoking and vaping marijuana workplaces, restaurants, bars, and other gambling facilities. VIEW PDF

Protecting Konsmokers from Secondhand Marijuana Smoke

This position paper provides information on marijuana smoke, policy trends, opposition arguments, case studies, and much more! READ NOW

Secondhand Marijuana Smoke Fact Sheet

This fact sheet describes the potential health burdens of secondhand marijuana smoke exposure. READ NOW

Smokefree is Smokefree Info Sheet

This one-page info sheet provides information on chemicals found in marijuana smoke, graphics, and recommendations for including marijuana in smokefree policies. READ NOW

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