

Secondhand marijuana smoke exposure in children

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**Mount
Sinai**

Support

- **R01CA181207-01A1**
 - Intervening with smoking parents of inpatients to reduce exposure (INSPIRE)
- **Flight Attendant Medical Research Institute**
- **Icahn School of Medicine at Mount Sinai**

Objectives

- ▶ Describe marijuana and its components
- ▶ Report on the results of three studies examining children's exposure to marijuana
- ▶ Discuss the implications of children's exposure to marijuana smoke





Background

- ▶ Sidestream marijuana smoke contains many chemicals found in tobacco smoke.
- ▶ Brief exposure to secondhand marijuana smoke has been shown to cause endothelial dysfunction in mice.
- ▶ Like tobacco, smoking marijuana has been associated with adverse health outcomes.
- ▶ Little is known about secondhand marijuana smoke exposure in children and any potential health effects it may have.
 - Increased ED visits for Otitis Media when combined with tobacco smoke
- ▶ Restrictions on use after legalization may encourage use around children

Primary components of marijuana

- ▶ Cannabinoids
- ▶ Biologically active molecules
- ▶ Bind to CB1 and CB2 receptors:
 - CB1 is found in the brain and nervous system
 - CB2 is found in immune system cells
- ▶ Humans make endocannabinoids
- ▶ Tetrahydrocannabinol
 - Primary active cannabinoid
- ▶ Cannabidiol
 - Primary target for therapeutics
- ▶ Crossbreeding



What is the prevalence of exposure in children

- Three studies:
 - 2 in Colorado
 - 1 in NYC
- Challenge:
 - Legal ramifications of identifying exposure
- CDC Laboratory:
 - High sensitivity testing

Objective

- To determine the prevalence of marijuana exposure in a cohort of children admitted to a hospital in Colorado for treatment of bronchiolitis.
 - Secondary aims included evaluating potential associations of marijuana exposure with patient demographics and secondhand tobacco smoke exposure.

Methods

Study population

- Families of children aged 31 days to 2 years admitted to Children's Hospital Colorado
- Diagnosis of bronchiolitis
- January 2013-May 2014
 - Secondary data analysis
 - Participants consented to having their data used for secondary research projects
 - Both studies received IRB approval

Methods

Data collection

- Parent survey
 - Demographics, child's health, secondhand tobacco exposure, home marijuana use (in 2014)
- Testing of child's urine
 - Cotinine
 - Δ^9 -tetrahydrocannabinol (THC) and a major metabolite of THC: 11-nor-9-carboxy-THC (COOH-THC)

Methods

Testing

- Specimens sent on dry ice to CDC
- Cotinine levels
 - Ultrahigh-performance liquid chromatography – tandem mass spectrometry (UHPLC – MS/MS)
 - Limit of detection: 0.03 ng/ml
- COOH-THC levels
 - UHPLC – MS/MS
 - Limit of detection: 0.015 ng/ml

Methods

Statistical analyses

- Descriptive statistics: frequencies, proportions, measures of central tendency
- Bivariate analyses: Fisher's exact test

Study Cohort

180 families were eligible to participate in the original study



99 families consented to participate (55%)

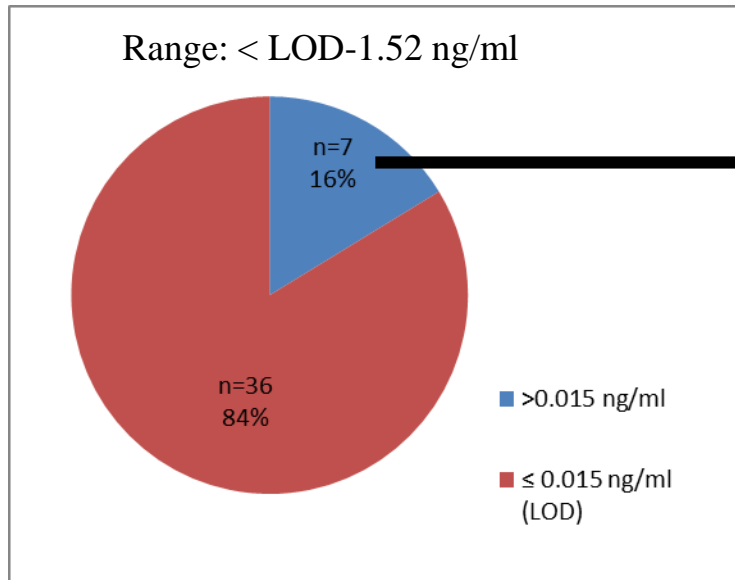


Tested for cotinine in urine from 86 children (89% of consenting families)



43 families consented to participate in future research studies (50%) and had urine tested at CDC for tobacco smoke and marijuana exposure

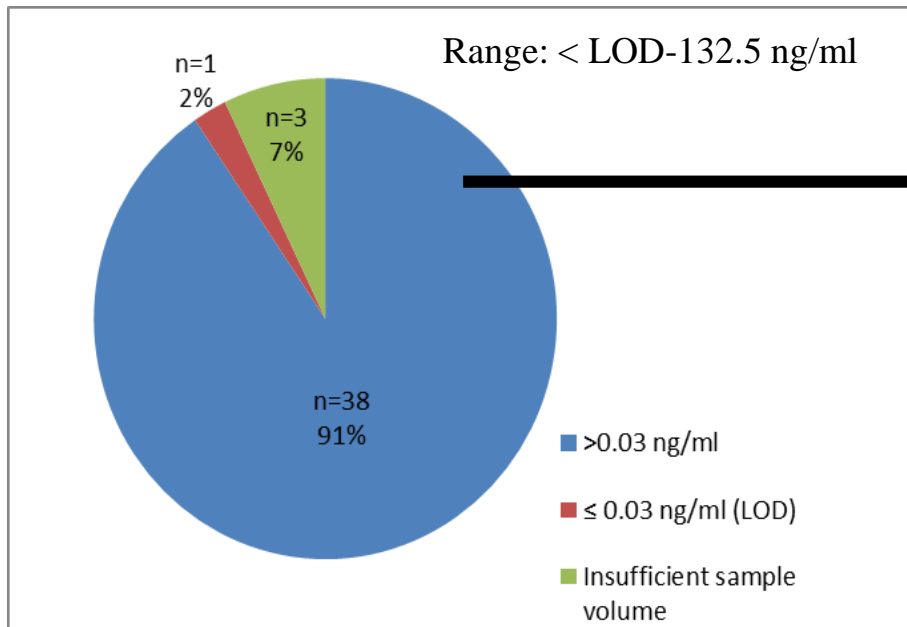
THC Results



Urinary COOH-THC (ng/ml)

N	7
Mean	0.48
75% Q3	1.26
50%	0.15
Median	0.09
25% Q1	

Cotinine Results



Urinary Cotinine (ng/ml)

N	38
Mean	5.87
75% Q3	1.44
50% Median	0.29
25% Q1	0.09

Characteristics of Patients by Marijuana Exposure (n=43)

	n, %						p-value
	Overall (n=43)		THC- (n=36)		THC+ (n=7)		
Gender							0.17
Female	10	23.3	10	100.0	0	0.0	
Male	33	76.7	26	78.8	7	21.2	
Age (years)							0.11
0	25	58.1	23	92.0	2	8.0	
1-2	18	41.9	13	72.2	5	27.8	
Race							0.03
White	34	79.1	31	91.2	3	8.8	
Not white	9	20.9	5	55.6	4	44.4	
Hispanic/Latino ethnicity							0.42
No	23	53.5	18	78.3	5	21.7	
Yes	20	46.5	18	90.0	2	10.0	
Multiunit housing							0.38
No	31	72.1	27	87.1	4	12.9	
Yes	12	27.9	9	75.0	3	25.0	

Tobacco and Marijuana Exposure

	n, %						p-value
	Overall		THC-		THC+		
Does anyone who lives in your home or who cares for your child smoke marijuana? (n=25)							0.02
Yes	4	16.0	1	25.0	3	75.0	
No	21	84.0	19	90.5	2	9.5	
Does anyone who lives in your home or care for your child use tobacco? (n=43)							0.08
Yes	12	27.9	8	66.7	4	33.3	
No	31	72.1	28	90.3	3	9.7	
Significant tobacco smoke exposure (n=43)*							0.002
Yes	9	20.9	4	44.4	5	55.6	
No	34	79.1	32	94.1	2	5.9	

Discussion

- Sixteen percent of our cohort were exposed to Marijuana.
- Positive associations between marijuana exposure and:
 - Reported marijuana use by household contacts
 - Non-white race
 - Exposure to tobacco smoke

Objective #2

- ▶ To determine the prevalence of marijuana smoke exposure among hospitalized children in Colorado with a parent who smokes tobacco
- ▶ To understand the relationship between parent-reported household marijuana use and biological measures of exposure
- ▶ To learn about the factors associated with marijuana smoke exposure in these children

Methods

Study population

- Parents of hospitalized children in Aurora, CO
- Ages 0-17
- Participants of a randomized controlled trial of a smoking cessation intervention for parents
- All were tobacco smokers

Methods

Data collection

▣ Parent survey

- Demographics, child's health, secondhand tobacco exposure, home marijuana use and policies

▣ Testing of child's urine

- Cotinine
- Δ^9 -tetrahydrocannabinol (THC)
- 11-nor-9-carboxy-THC (COOH-THC)
- 11-hydroxyl THC (OH-THC)
- Cannabidiol (CBD)
- Cannabinol (CBN)

Methods

Testing

▣ Specimens sent on dry ice

– Cotinine levels (UCSF)

- Ultrahigh-performance liquid chromatography – tandem mass spectrometry (UHPLC – MS/MS)
- Limit of detection: 0.03 ng/ml

– THC levels (CDC)

- THC, OH-THC, COOH-THC, CBD, CBN
- UHPLC – MS/MS
- Limit of detection: 0.015 ng/ml

Methods

Statistical analyses

- Descriptive statistics: frequencies, proportions, measures of central tendency
- Bivariate analyses: Chi-square
- Correlation
- SAS



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(Ben Livingston, The Cannabist)

Stealth PUFFIT vaporizer mimics asthma inhaler (review)

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By Ben Livingston, The Cannabist Staff

If you're like me, you want to get high in public. All of the city's people are so much nicer when you're high: the bosses, the beggars, the bicyclists, the bus and taxi drivers. Sidewalk skateboarders seem to have such fun, shallow-conversationed shoppers are such a hoot, and you enjoy banter with proof-of-payment-demanding private transit police when you're high.

The problem — the one and only problem, of course — is that our society, now waking from 80 years of paranoid pot prohibition, hasn't yet come to appreciate the great communal benefit we could realize by allowing urban potheads their lunchtime puff to help deal with all of the damn people around them. So public pot smoking is still illegal, even in places where pot is now legal. Serious bummer, I know.

The solution — the one and only solution, of course — is to be super sneaky when getting high in public. Unless you're aiming for civil disobedience, keep the herb on the down low. On a deeper political level, discretion can help stave off negative backlash by the suits and the squares who lump all pot smokers together as jobless hippies best legislated against. But mostly, you just don't want to get caught by police, because the fuzz can totally buzzkill your sweet high.



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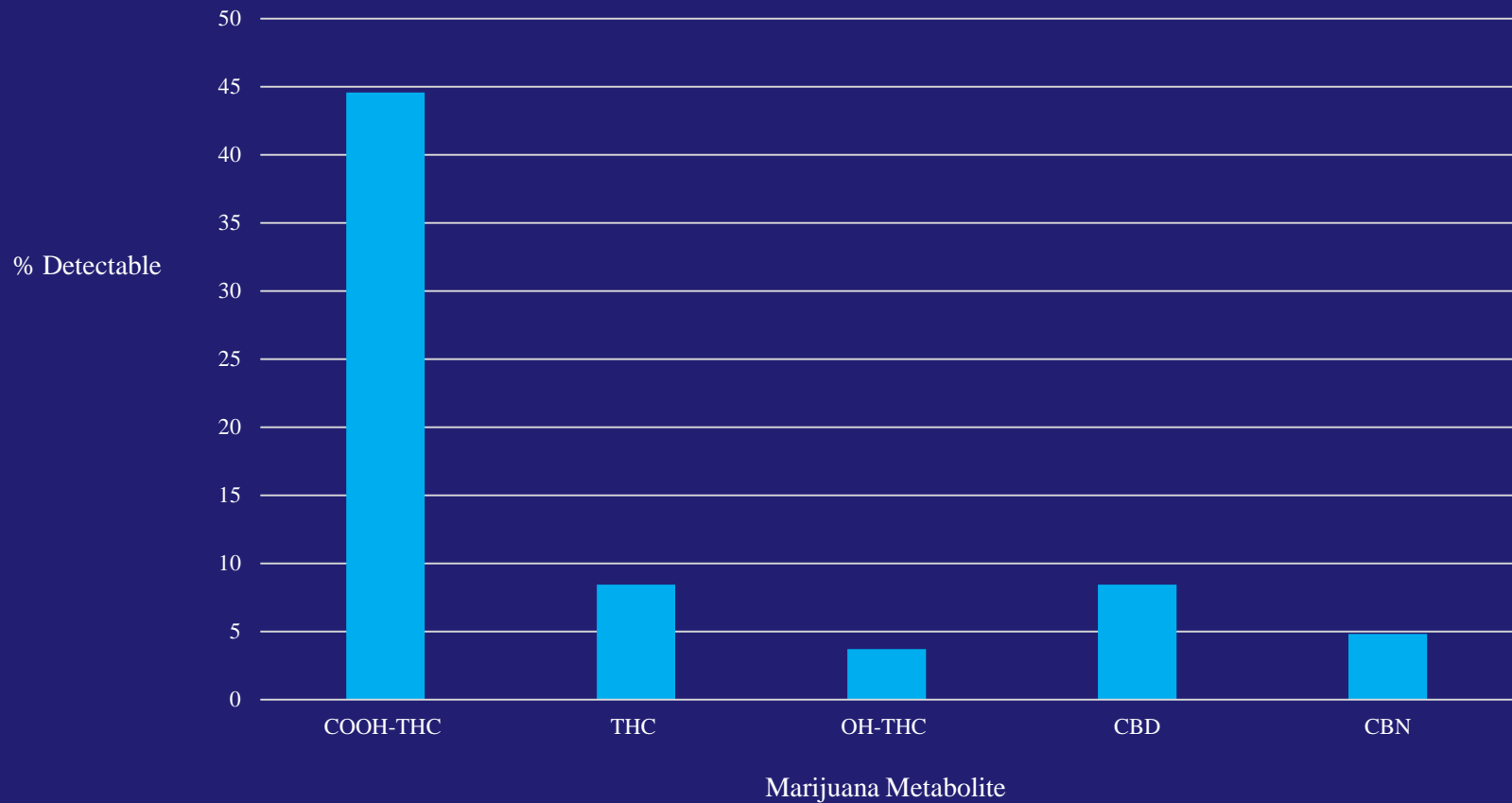
WHAT DO YOU THINK?

Which type of weed do you prefer?

- Sativa
- Indica
- I like them equally

Characteristics of Study Participants, n=83		
	N	%
Child		
Age in years (median, IQR)	6.0 (9.0)	
Male gender	47	56.6
Hispanic/Latino ethnicity	32	38.6
Race (n=82)		
White	45	54.2
Black/African American	10	12.1
Other	27	32.5
Parent		
Age in years (median, IQR)	33.0 (11.0)	
Number of people living in household (median, IQR)	5.0 (2.0)	
On average day, number of cigarettes smoked (median, IQR) (n=82)	10.0 (10.0)	
Marital status		
Married or member of a couple	45	54.2
Single (never been married)	25	30.1
Divorced, widowed or separated	13	15.7
Highest educational level (n=80)		
Less than a high school graduate	19	22.9
Grade 12 or GED (high school graduate)	16	19.3
At least some college	45	54.2
Household income from all sources before taxes last year (n=75)		
<=\$25,000	31	37.4
\$25,001-\$50,000	27	32.5
>=\$50,001	17	20.5
Has ever used an e-cigarette, even once or twice	69	83.1
Current vape/e-cigarette use		
Every day	3	3.6
Some days	13	15.7
Not at all	67	80.7
Housing status		
A mobile home, trailer, or manufactured home	10	12.1
A house detached from any other house (standalone home)	41	49.4
A house attached to one or more houses (duplex, triplex, townhouse, or rowhouse)	16	19.3
An apartment building	16	19.3

Proportion of Patients with Detectable Marijuana Metabolites and Geometric Mean Values



Characteristics of THC+ Participants

Participant	Child's age	THC level	UC level	Parental report of current marijuana use
1	1	0.02	0.93	Some days
2	3	0.01	1.28	Some days
3	4	0.02	11.12	Every day
4	7	0.33	72.8	Every day
5	14	0.13	0.31	Not at all
6	15	0.51	1.02	Some days
7	16	0.01	0.08	Not at all

Responses to Marijuana and Tobacco Questions (n=83)

	N	%
<u>Marijuana</u>		
Has ever used marijuana, even one or two times	70	84.3
Has a medical marijuana license (n=27)	9	10.8
Form(s) of marijuana regularly used:		
Smoked (pipes, joints, bong)	25	30.1
Edibles	12	14.5
Vaporizer	8	9.6
Flavored drops	3	3.6
Pills	0	0.0
Beverages	2	2.4
Dabs	1	1.2
Oil pipe vaporizer	1	1.2
Water bong and fask mask	1	1.2
Current marijuana smoking frequency (n=82)		
Every day	9	10.8
Some days	19	22.9
Not at all	54	65.1
How often does anyone smoke marijuana inside your home?		
Don't know	2	2.4
Daily	6	7.2
Weekly	3	3.6
Monthly	4	4.8
Never	68	81.9
In general, what usually happens when you, friends, or other family members want to smoke marijuana when the children are at home? (n=75)		
I/we never smoke when the children are home	43	51.8
I/we smoke in another room or floor of my home away from the children	8	9.6
I/we step outside when the children are home	18	21.7
I/we smoke anywhere that it is convenient inside my home	0	0.0
I/we smoke in a location where I/we can keep an eye on the children	0	0.0
NO one smokes marijuana inside or outside the home	0	0.0
<u>Tobacco</u>		
Over the past 3 months, has anyone smoked tobacco anywhere inside your home? (n=81)		
No	61	76.3
Yes	20	24.7
Please tell me which best describes how cigarette smoking is handled in your home? (n=80)		
No one is allowed to smoke anywhere	52	65.0
Smoking is permitted in some places or at some times	25	31.3
Smoking is permitted anywhere	3	3.8

Bivariable analysis of Dichotomized COOH-THC and Demographics (n=83)

	<LOD COOH-THC		≥ LOD COOH-THC		p-value*
	N	%	N	%	
Child					
Age in years (median)	5		6		0.10
Gender					0.64
Male	25	54.4	22	59.5	
Female	21	45.7	15	40.5	
Ethnicity					0.90
Hispanic/Latino ethnicity	18	39.1	14	37.8	
Not hispanic/Latino ethnicity	28	60.9	23	62.2	
Race (n=82)					0.47
White	26	56.5	19	52.8	
Black/African American	7	15.2	3	8.3	
Other	13	28.3	14	38.9	
Parent					
Age in years (median)	33		35		0.47
Marital status					0.05
Single (never married)	12	26.1	13	35.1	
Divorced, widowed, separated	4	8.7	9	24.3	
Married or member of a couple	30	65.2	15	40.5	
Highest educational level (n=80)					0.33
<High school graduate	8	17.8	11	31.4	
High school graduate	9	20.0	7	20.0	
Some college/college graduate	28	62.2	17	48.6	
Household income from all sources before taxes last year (n=75)					0.22
≤\$25,000	14	33.3	17	51.5	
\$25,001-\$50,000	16	38.1	11	33.3	
≤\$50,001	12	28.6	5	15.2	
Housing status					0.68
A mobile home, trailer, or manufactured home	5	10.9	5	13.5	
A house detached from any other house (standalone home)	25	54.4	16	43.2	
A house attached to one or more houses (duplex, triplex, townhouse, or rowhouse)	9	19.6	7	18.9	
An apartment building	7	15.2	9	24.3	
On average day, number of cigarettes smoked (n=82)	10		10		0.84

*Chi-square or Wilcoxon rank sum tests

Bivariable Analysis of Dichotomized COOH-THC and Marijuana and Tobacco Use

	<LOD COOH-THC		≥ LOD COOH-THC		p-value*
	N	%	N	%	
Marijuana					
Has ever used marijuana, even one or two times (n=82)					0.42
Yes	38	54.3	32	45.7	
No	8	66.7	4	33.3	
Has a medical marijuana license (n=27)					1.00
Yes	4	44.4	5	55.6	
No	7	38.9	11	61.1	
Form(s) of marijuana regularly used:					
Smoked (pipes, joints, bongs)	7	28.0	18	72.0	0.001
Edibles	5	41.7	7	58.3	0.30
Vaporizer	2	25.0	6	75.0	0.13
Flavored drops	0	0.0	3	100.0	0.08
Beverages	0	0.0	2	100.0	0.20
Other (Oil pipe vaporizer, dabs, water bong and face mask)	0	0.0	3	100.0	0.08
Current marijuana smoking frequency (n=82)					0.0009
Every day	0	0.0	9	100.0	
Some days	10	52.6	9	47.4	
Not at all	35	64.8	19	35.2	
How often does anyone smoke marijuana inside your home?					<.0001
Daily	0	0.0	6	100.0	
Weekly	1	33.3	2	66.7	
Monthly	0	0.0	4	100.0	
Never	44	64.7	24	35.3	
In general, what usually happens when you, friends, or other family members want to smoke marijuana when the children are at home?					
I/we never smoke when the children are home	25	58.1	18	41.9	0.61
I/we smoke in another room or floor of my home away from the children	0	0.0	8	100.0	0.001
I/we step outside when the children are home	12	66.7	6	33.3	0.28
Tobacco					
Over the past 3 months, has anyone smoked tobacco anywhere inside your home? (n=81)					0.002
No	40	65.57	21	34.43	
Yes	5	25	15	75	
Please tell me which best describes how cigarette smoking is handled in your home? (n=80)					0.32
No one is allowed to smoke anywhere	32	61.54	20	38.46	
Smoking is permitted in some places or at some times	11	44	14	56	
Smoking is permitted anywhere	1	33.33	2	66.67	
Urinary cotinine (geometric mean)	0.81		1.39		0.12
Urinary NNAL (geometric mean)	21.59		24.47		0.52

*Chi-square, Fisher's exact or Wilcoxon rank sum tests



nugtella



Hazelnut spread with
Medical Marijuana



Discussion

- ▶ Almost half of children in our cohort were exposed to marijuana.
- ▶ Strong association between level of tobacco exposure and level of marijuana exposure
- ▶ Marijuana use in the home is a strong predictor of exposure
- ▶ But still misses a significant number of exposed children



Objective #3

- ▣ Determine the prevalence of marijuana smoke exposure among children presenting to the clinic or inpatient ward in New York City
- ▣ Pilot study to demonstrate feasibility for a prospective cohort study of children

Methods

- ▶ Parents of children ages 1-2 years presenting to the Pediatric Associates Clinic at Mount Sinai, or the inpatient ward
- ▶ Anonymous questionnaire and urine collection
- ▶ Same urine analysis as prior studies

Results

- ▶ 21% had detectable COOH-THC
- ▶ 16% of parents reported that a caregiver or someone living in the home used marijuana
- ▶ 11% reported their child had been exposed in the past 3 days

Limitations

- ▶ Generalizability
- ▶ Sample size
- ▶ Only children with parental tobacco users
- ▶ Self-reported data
- ▶ Assumption that exposure is from secondhand marijuana smoke

Other sources of exposure?

▣ Questions about incursions

- Excellent evidence for tobacco smoke incursions
- HUD rule prohibiting smoking in MUH
- Anecdotal data from parents:
 - Marijuana smoke incursions

Implications

- ▶ A substantial proportion of children in Colorado and NYC are exposed to marijuana smoke.
- ▶ The risk is particularly high in children with parents who smoke tobacco.
- ▶ Understanding the consequences of marijuana smoke exposure in children is critical and urgent, especially as marijuana becomes increasingly legal and available.
- ▶ Parents should be informed not to smoke around children; there isn't evidence that secondhand marijuana smoke exposure in children is safe.
- ▶ Regulations should prohibit smoking marijuana around children, and in multi-unit housing.

References

- Moir D, Rickert WS, Levasseur G, Larose Y, Maertens R, White P, Desjardins S. A comparison of mainstream and sidestream marijuana and tobacco cigarette smoke produced under two machine smoking conditions. *Chem Res Toxicol*. 2008 Feb;21(2):494-502.
- Wei B, Wang L, Blount BC. Analysis of cannabinoids and their metabolites in human urine. *Anal Chem*. 2015 Oct 5.
- Rubino T, Parolaro D. The Impact of Exposure to Cannabinoids in Adolescence: Insights from Animal Models. *Biol Psychiatry*. 2015 Aug 7.
- Lisdahl KM, Price JS. Increased Marijuana Use and Gender Predict Poorer Cognitive Functioning in Adolescents and Emerging Adults. *J Int Neuropsychol Soc*. 2012 Jul;18(4):678-88.
- Price JS, McQueeney T, Shollenbarger S, Browning EL, Wieser J, Lisdahl KM. Effects of marijuana use on prefrontal and parietal volumes and cognition in emerging adults. *Psychopharmacology (Berl)*. 2015 Aug;232(16):2939-50.
- Yolton K, Dietrich K, Auinger P, Lanphear BP, Hornung R. Exposure to Environmental Tobacco Smoke and Cognitive Abilities among U.S. Children and Adolescents. *Environ Health Perspect*. 2005 Jan;113(1):98-103.

Gage SH, Hickman M, Zammit S. Association Between Cannabis and Psychosis: Epidemiologic Evidence. *Biol Psychiatry*. 2015 Aug 12. pii: S0006-3223(15)00647-2.

Lubman DI, Cheetham A, Yücel M. Cannabis and adolescent brain development. *Pharmacol Ther*. 2015 Apr;148:1-16.

Volkow ND, Baler RD, Compton WM, Weiss SR. Adverse Health Effects of Marijuana Use. *N Engl J Med*. 2014 Jun 5;370(23):2219-27.

Goniewicz ML, Eisner MD, Lazcano-Ponce E, Zielinska-Danch W, Koszowski B, Sobczak A, Havel C, Jacob P, Benowitz NL. Comparison of Urine Cotinine and the Tobacco-Specific Nitrosamine Metabolite 4-(Methylnitrosamino)-1-(3-Pyridyl)-1-Butanol (NNAL) and Their Ratio to Discriminate Active From Passive Smoking. *Nicotine Tob Res*. 2011 Mar;13(3):202-8.

Goldschmidt L, Richardson GA, Cornelius MD, Day NL. Prenatal marijuana and alcohol exposure and academic achievement at age 10. *Neurotoxicol Teratol*. 2004 Jul-Aug;26(4):521-32.

Richardson GA, Ryan C, Willford J, Day NL, Goldschmidt L. Prenatal alcohol and marijuana exposure: effects on neuropsychological outcomes at 10 years. *Neurotoxicol Teratol*. 2002 May-Jun;24(3):309-20.

Noland JS, Singer LT, Short EJ, Minnes S, Arendt RE, Kirchner HL, Bearer C. Prenatal drug exposure and selective attention in preschoolers. *Neurotoxicol Teratol*. 2005 May-Jun;27(3):429-38.

Thank you

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